

Black-Footed Ferret Recovery Plan



BLACK-FOOTED FERRET
RECOVERY PLAN

(Original Approval: June 14, 1978)

APPROVED

DATE: 8-8-88

U. S. Fish and Wildlife Service: *Robert B. Buntz*
Regional Director

DISCLAIMER

This is the completed Black-footed Ferret Recovery Plan. It has been approved by the U.S. Fish and Wildlife Service. It does not necessarily represent official positions or approvals of cooperating agencies, and it does not necessarily represent the views of all individuals who played a key role in preparing this plan. This plan is subject to modifications as dictated by new findings, changes in species status, and completion of tasks described in the plan. Goals and objectives will be attained and funds expended contingent upon appropriations, priorities, and other constraints.

Acknowledgments should read as follows:

The Black-footed Ferret Recovery Plan, dated August 8, 1988, prepared for the U.S. Fish and Wildlife Service by Steven C. Forrest, who was under contract, and Dean **Biggins**, National Ecology Research Center. .

Literature citations should read as follows:

U.S. Fish and Wildlife Service. 1988. Black-footed Ferret Recovery Plan.
U.S. Fish and Wildlife Service, Denver, Colorado. 154 pp.

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ACKNOWLEDGMENTS

The authors wish to thank many contributors for their assistance and guidance in the preparation of this plan. Ron Crete, U.S. Fish and Wildlife Service, Endangered Species Field Office, Helena, Montana; U.S. Seal, International Union for the Conservation of Nature, Minneapolis, Minnesota; and Max Schroeder, Office of Endangered Species, U.S. Fish and Wildlife Service, Denver, Colorado, provided a planning strategy and helped guide the plan throughout its development. Bob **Oakleaf**, Wyoming Game and Fish Department, provided important review and insight from his planning perspective. Tom Thorne, D.V.M., Wyoming Game and Fish Department, provided valuable insight due to his experience with the ferrets in captivity and in the wild. Manuscript review and guidance was provided by:

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Nate Flesness International Species Inventory System
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Discussion with others, including Beth Williams, University of Wyoming; Ellen Diernfeld, Bronx Zoo; and Bob May, Princeton University, provided other useful insights. We thank all of these individuals for what we hope is a successful contribution to black-footed ferret recovery.'

Cover by Sylvia Feder

PREFACE

The Black-footed Ferret Recovery Plan outlines steps for recovery of the black-footed ferret (Mustela nigripes) throughout its historical range. Evidence suggests that the ferret was widely distributed and was probably common prior to the destruction of its principal prey and associate, the prairie dog (Cynomys spp.). A recent outbreak of canine distemper in Wyoming led to removal, to a captive breeding facility in Wyoming, of the last known ferrets in the wild. Despite the **extreme** susceptibility of the black-footed ferret to canine distemper, a strategy has been suggested in this plan to anticipate-local extinctions of populations reintroduced from captive-bred stock generated by the 58 remaining ferrets in captivity so that the ferret may be returned to the wild and managed with minimum intervention.

The goal for black-footed ferret recovery is to: (1) increase the number of captive ferrets to a facility capacity of 200 breeders by 1991, and (2) establish populations, which before breeding, number 1,500 black-footed ferrets in 10 or more populations in the wild. A six-step process has been outlined to reach this objective, beginning with ensuring success of captive breeding, locating reintroduction habitat, finding other populations of ferrets, devising release strategies, managing reintroduced and other populations, and building programs for public support of the *recovery* effort.

The recovery goals are attainable, requiring less than one-tenth of 1 percent of the total western rangelands (**185,000-250,000** ac, or **75,000-100,000** ha) to secure sufficient habitat for recovery. Initial success with captive breeding in 1987 suggests sufficient ferret *stock* can be produced to fill those habitats.

PART I

INTRODUCTION

The black-footed ferret (Mustela ~~nigripes~~ Audubon and **Bachman, 1851**), a nocturnal prowler of the once vast **American** prairies, was elevated to instant celebrity following its discovery near Meeteetse, Wyoming, in 1981 after 8 years of failure to document its existence in the wild (Schroeder and Martin 1982, Clark 1983). The story of its rediscovery has been one of the most exciting and widely reported wildlife events of the 1980's. Yet progress toward achieving recovery goals since adoption of the original Black-footed Ferret Recovery Plan (U.S. Fish and Wildlife Service 1978) has been limited. The opportunity for aggressive action to **ensure recovery** of the black-footed ferret is now available.

Environmental plans may fail to achieve their objectives for reasons other than scientific ones (Orians et al. 1986). The original **Black-footed** Ferret Recovery Plan was written at a time when no ferrets were known in the wild, and its focus was broad. The rediscovery of wild black-footed ferrets, development of recent models of small populations and their behavior, new concepts for viewing the mechanisms and rates of extinctions, and formalized models for more effective decision making which **can** be applied to black-footed ferret recovery, all suggest new planning directions for this species.

This revised plan is written at a time of great uncertainty and hope for the future of the black-footed ferret. In 1985, an epizootic of canine distemper decimated the Wyoming ferret population (Forrest et al. in press; Thorne and Belitsky in press; Williams et al. in press). As this plan details, the fate of this population, and perhaps the species, now depends on successful captive reproduction of the survivors of that catastrophe. Regardless of the potential for finding other ferret populations, our present understanding of the dynamics of small, insular populations in general and black-footed ferrets specifically makes it clear that recovery of this species will require maintenance of a reservoir of captive stock into the foreseeable future. The birth and survival of young black-footed ferrets in 1987 *suggests we can* accomplish timely recovery.

In 1987, the Wyoming Game and Fish Department (Wyoming Department) developed its first Strategic Plan for the management of the black-footed ferret in Wyoming (Wyoming Game and Fish Department **1987a**, Ballou and **Oakleaf** 1987). That effort, like comprehensive efforts in Montana to search for and identify black-footed ferret habitat (Clark et al. **1987**), is an important step that must be integrated into a national recovery effort as required by the Endangered Species Act (Act) of 1973. This plan incorporates these and other works into an integrated framework for organizing individuals and agencies for recovery of the black-footed ferret.

Description

The black-footed ferret is one of five members of the genus Mustela in North America (Hall 1981). Black-footed ferrets are closely allied to two species of Eurasian polecats, the Siberian polecat (M. **eversmanni**) and the European

polecat (M. putorius) (Youngman 1982, O'Brien et al. in press), from which ancestral black-footed ferrets arose (Anderson et al. 1986). Molecular phylogeny of M. nigripes and M. evermanni, the nearest relative found throughout eastern Asia (Stroganov 1962), provides evidence that the two groups diverged approximately 0.5-2 million years before present (O'Brien et al. in press), although the fossil record would indicate a more recent separation (Anderson in press). The two forms are separated within the lower range of genetic distances accorded to true species (O'Brien et al. in press). No subspecies of black-footed ferret are recognized based on morphometric analysis of extant cranial remains (Anderson et al. 1986).

Life History

Black-footed ferrets are mostly nocturnal, solitary carnivores that are nearly obligate associates of the prairie dog (Cynomys spp.) (Henderson et al. 1969, Hillman and Linder 1973, Forrest et al. 1985a). Ferrets live in the burrows made by prairie dogs and use prairie dogs for food. Black-footed ferret dependence on this prey species probably evolved shortly after ferrets entered North-America through Beringia during the Sangamonian, about 100,000 years before present (Anderson 1977); Cynomys remains have been found in about 50 percent of Pleistocene and Holocene cave faunas containing ferret remains (Anderson et al. 1986). The historical range of the black-footed ferret is nearly identical to that of three prairie dog species, the black-tailed prairie dog (C. ludovicianus), Gunnison's prairie dog (C. gunnisoni), and the white-tailed prairie dog (C. leucurus) (Anderson et al. 1986). Less than 2 percent of 412 known ferret specimens listed by Anderson et al. (1986) were collected in the absence of prairie dogs, although all were from within the prairie dog range. Black-footed ferrets almost never are seen in habitats other than prairie dog colonies (Henderson et al. 1969). Radio-telemetered and snow-tracked black-footed ferrets only left prairie dog colonies when traveling to adjacent prairie dog colonies (Forrest et al. 1985a, Biggins et al. 1985, Richardson et al. 1987), and a radio-tracked ferret avoided use of other areas which included areas occupied by ground-squirrel (Spermophilus armatus) colonies (Biggins et al. 1985).

As is true for most small carnivores, many aspects of black-footed ferret life history are incomplete (King 1983). A review of the literature indicates that more detail is known about black-footed ferrets than about some common weasels (e.g., Mustela frenata) (Forrest et al. 1985b), but other aspects of ferret life history in the wild, including reproductive and early developmental behavior, are unknown (Erickson 1973, Forrest et al. in press). Only two populations of the species have been studied; one in Hellette County, South Dakota, from 1964-1974 and the second in Park County, near Heeteetse, Wyoming, from 1981-1986.

Black-footed ferret densities in Park County, Wyoming, were linearly correlated with white-tailed prairie dog colony size, with an average density of one adult black-footed ferret per 99-148 ac (40-60 ha) of prairie dog colony (Forrest et al. 1985a). The smallest colony size which supported one adult ferret for a minimum of 1 year in Wyoming was 31 ac (12.5 ha), which was the minimum size recommended by Hillman et al. (1979) from South Dakota studies where ferrets occurred with black-tailed prairie dogs. In Wyoming,

ferrets averaged one litter/141 ac (57 ha) of white-tailed prairie dog colony; litters were not observed on colonies less than 121 ac (49 ha) in size (Forrest et al. 1985a). A female radio-tracked for 43 days used 131 ac (53 ha) during fall (Biggins et al. 1985), and a female and her litter observed daily used 101 ac (41 ha) over 33 days in the summer (Paunovich and Forrest, in press). Six of eleven litters observed in South Dakota occupied colonies in excess of 99 ac (40 ha) with an average of one litter/74 ac (30 ha) of black-tailed prairie dog colony (Hillman et al. 1979).

In addition to prairie dogs, which comprised 91 and 87 percent of scats by occurrence in two food habits studies (Sheets et al. 1972, Campbell et al. 1987), ferrets also eat lagomorphs, mice (cricetids), voles (microtines), ground squirrels (sciurids), pocket gophers (aeomyidae), birds, and insects (Hillman 1968, Henderson et al. 1969, Sheets et al. 1972, Clark et al. 1985a, 1986b, Campbell et al. 1987). Ferrets were also observed to cache prairie dogs (Richardson et al. 1987) and consume prairie dog carrion (Fagerstone in press). Confined captive ferrets consumed approximately 60-360 g of whole prey and ground food/day (Progulske 1969), or 40-100 g of whole prairie dog/day when they chose to eat at all (S. Joyce pers. comm.). Based on snow-track data from Wyoming, which gave the linear distance of nightly ferret travel, and a study of M. eversmanni fed ground prairie dogs (Powell et al. 1985), it is estimated that black-footed ferrets may need about 124 kcal of prairie dog/day. Because one prairie dog represents about 890-1,025 metabolizable kcal, one prairie dog represents 6-7 days of food for an adult ferret (Powell et al. 1985) if there is no waste or spoilage. Female black-footed ferrets with young probably require greater energy, as lactating female weasels may require three times as much energy as nonlactating adult weasels (East and Lockie 1964, Powell and Leonard 1983). Badgers may use 16 times more energy during lactation than during gestation (Harlow et al. 1985). Bioenergetic demand of ferrets is, therefore, likely to vary seasonally and individually.

Richardson et al. (1987) observed that male and female ferrets shared common burrows in Wyoming in late March. Breeding of captive South Dakota black-footed ferrets in Maryland occurred from March to April (Carpenter and Hillman 1979) and in April and May in Wyoming (E.T. Thorne pers. comm.). Copulatory behavior was also observed in February (DonCarlos et al. in press). Long copulations, lasting 1-4 hours, were observed (Carpenter and Hillman 1979, B.J. Miller pers. comm., E.T. Thorne pers. comm.). Female black-footed ferrets are estrous for 8 or 9 days (Hillman and Carpenter 1983) and could be polyestrous (more than one estrus cycle per season) based on the biology of its cogeners (Carpenter and Hillman 1979, Mead in press), although no "late" litters were observed in the wild (Forrest et al. 1985b).

Gestation ranged from 41 to 45 days (Carpenter and Hillman 1979, E.T. Thorne pers. comm.). Only one female tagged as a juvenile in Wyoming was recaptured at 1 year, and she reproduced in the wild at that age (Forrest et al. in press). Two 1-year-old captive males produced viable sperm (Kitchin and Atherton 1987), and one copulated (E.T. Thorne pers. comm.).

Litter sizes in the wild ranged from 1-5 young and averaged **3.3-3.4/litter**, approximately 8 weeks postpartum (Linder et al. 1972, Forrest et al. in press). Of four litters born in captivity, one contained six young, two contained five young, and one contained two young (Carpenter and Hillman 1979, E.T. Thorne pers. comm.). The sex ratio of **Wyoming juveniles** born in the wild did not differ significantly from **1:1** (Forrest et al. in press). In **summer** populations of free-ranging Wyoming ferrets, about 70 percent of the population was comprised of juveniles (Forrest et al. in press)..

Adult sex ratios of two females per male differed significantly from unity and from the juvenile sex ratio (Forrest et al. in press). This was largely an artifact of high "disappearance" from juvenile to adult age classes, estimated to be between 56 and 81 percent annually (Forrest et al. in press). Because males typically had larger home ranges than females (**Biggins** et al. 1986, Richardson et al. in press) and juvenile males made longer dispersal movements from their natal areas (Forrest et al. in press), fewer males were likely to survive to age, 1. Disappearance was assumed equivalent to mortality once animals dispersed from prairie dog colonies within the Meeteetse complex (Forrest et al. **1985a**), as no black-footed ferrets were ever found living outside of the complex. Highest declines in population densities on the largest prairie dog colony within the Meeteetse complex occurred from September, when dispersal peaked, until the following **March**. Black-footed ferret densities observed in March were only slightly higher than **summer** adult densities, suggesting little mortality or **immigration** occurred between the breeding season and the time litters emerged (Forrest et al. in press). Life expectancies for adults in the wild were probably less than 5 years (Forrest et al. **1985b**, Forrest et al. in press).

Henderson et al. (1969) documented numerous cases of man-caused ferret mortality in South Dakota, primarily road-kills and trap-kills. Probably due to the remoteness of the Wyoming site, man-caused mortality at Meeteetse was not as significant. Predators were the principal cause of all **radio-telemetered** mortality from 1981-1984 (Forrest et al. in press). Predators included great-horned owls (**Bubo virginianus**), golden eagles (**Aquila chryseatos**), and coyotes (**Canis latrans**). Potential but undocumented predators included badgers (**Taxidea taxus**), bobcats (**Lynx rufus**), foxes (**Vulpes spp.**), prairie falcons (**Falco mexicanus**), and ferruginous hawks (**Buteo** **reaaliq**) (Henderson et al. 1969, Forrest et al. in press).

Disease was the most significant influence on ferret population dynamics in Wyoming. In 1985, it is believed that canine distemper reduced the Meeteetse population by 50 percent each month from August through October, until the epizootic ran its course (Forrest et al. in press). Black-footed ferrets have no natural **immunity** to canine distemper (Carpenter et al. 1976, Carpenter and Hillman 1979). Black-footed ferrets are probably susceptible to human influenza, rabies, tularemia, pseudotuberculosis, leptospirosis, botulism, tuberculosis, staphylococcosis, streptococci, mange, **earmites**, ringworm, and tick and flea infestations (Carpenter 1985, Thorne et al. 1985). Black-footed ferrets also may be susceptible to Aluetian disease of mink (Porter et al. 1982).

Status and Distribution

All ferrets known to be extant (n = 18) from the Meeteetse, Wyoming, population were removed and placed at the Wyoming Department's captive breeding facility at **the Sybille** Wildlife Research and Conservation Education Center from 1985 through 1987 (Table 1, Wyoming Game and Fish Department **1987a**, E. T. Thorne pers. **comm.**).

In addition, eight young were produced in two litters in captivity in 1987 (E. T. Thorne pers. **comm.**). One of the young died shortly after birth, bringing the total number of ferrets in captivity to 25 by fall 1987. One ferret died in December 1987 bringing the population to 24 before the 1988 breeding season. Thirteen litters (44 kits) were born in the 1988 breeding season and 34 survived. The total population at this writing is 58 animals. No other black-footed ferrets are known in the wild.

Distribution from the 1800's to 1964

Black-footed ferrets formerly ranged from the Great Plains of Canada to intermontane regions of the interior Rocky Mountains and Southwest (Fig. 1). Although no recent specimens are known from Mexico, black-tailed prairie dog distributions from north-central Chihuahua (Lesueur 1945) and the location of Pleistocene ferret skeletal material in Chihuahua (Messing 1986) suggest black-footed ferrets may have occurred there within recent history as well. North American Plains Indians were familiar with the species prior to the arrival of European man (Anderson et al. **1986**), commonly using ferret skins as ceremonial objects and including them in stories (Grinnell 1895, Henderson et al. 1969, Clark 1975). American Fur Company records from the 1830's indicate ferrets were frequently trapped on the plains of the upper Missouri Basin (Johnson 1969). Several investigators (Linder et al. 1972, **Hillman** 1974, Choate et al. 1982, Hubbard and Schmitt 1984, Anderson et al. 1986, **Biggins** and Schroeder in press) believe black-footed ferrets were historically more **common** than previously thought. They conclude that black-footed ferrets are difficult to observe without high-intensity lights not commonly available until the **1950's**, that many ferrets caught by trappers and control agents probably went unreported because ferrets were not economically important, that specimen collection was quite extensive despite the supposed rarity of the species (356 specimens from 1880-1964 (Anderson et al. **1986**)), and that more habitat was available to ferrets historically.

Prairie dogs were formerly abundant on the prairies of the continent. Merriam (1902) estimated areas occupied by prairie dogs in the late **1800's** totaled about **692,000,000 ac (280,000,000 ha)**. Nelson (1919) and Anderson et al. (1986) estimated **100,000,000 ac (40,000,000 ha)** still remained in the 1910's. If this habitat were fully occupied by ferrets at the levels observed at Meeteetse, as many as 5.6 million black-footed ferrets could have been supported in the late 1800's. Based on this assumption, black-footed ferrets do not appear to have been a species of limited distribution prior to arrival of European man in North America. With the advent and improved distribution of inexpensive and effective rodenticides in the early 1900's and expanded agricultural **tillage**, prairie dogs were rapidly eliminated from much of their

Table 1. **Ages** and sexes of wild-caught black-footed ferrets at the Sybille Wildlife Research and Conservation Education Center in July 1987.

	Estimated age of captive wild-caught black-footed ferrets (in years) in July 1987.			
	1	2	3	4
Number of Males	3	2	2*	0
Number of Females	5	1	2*	3*

*Minimum age of unknown-aged individuals

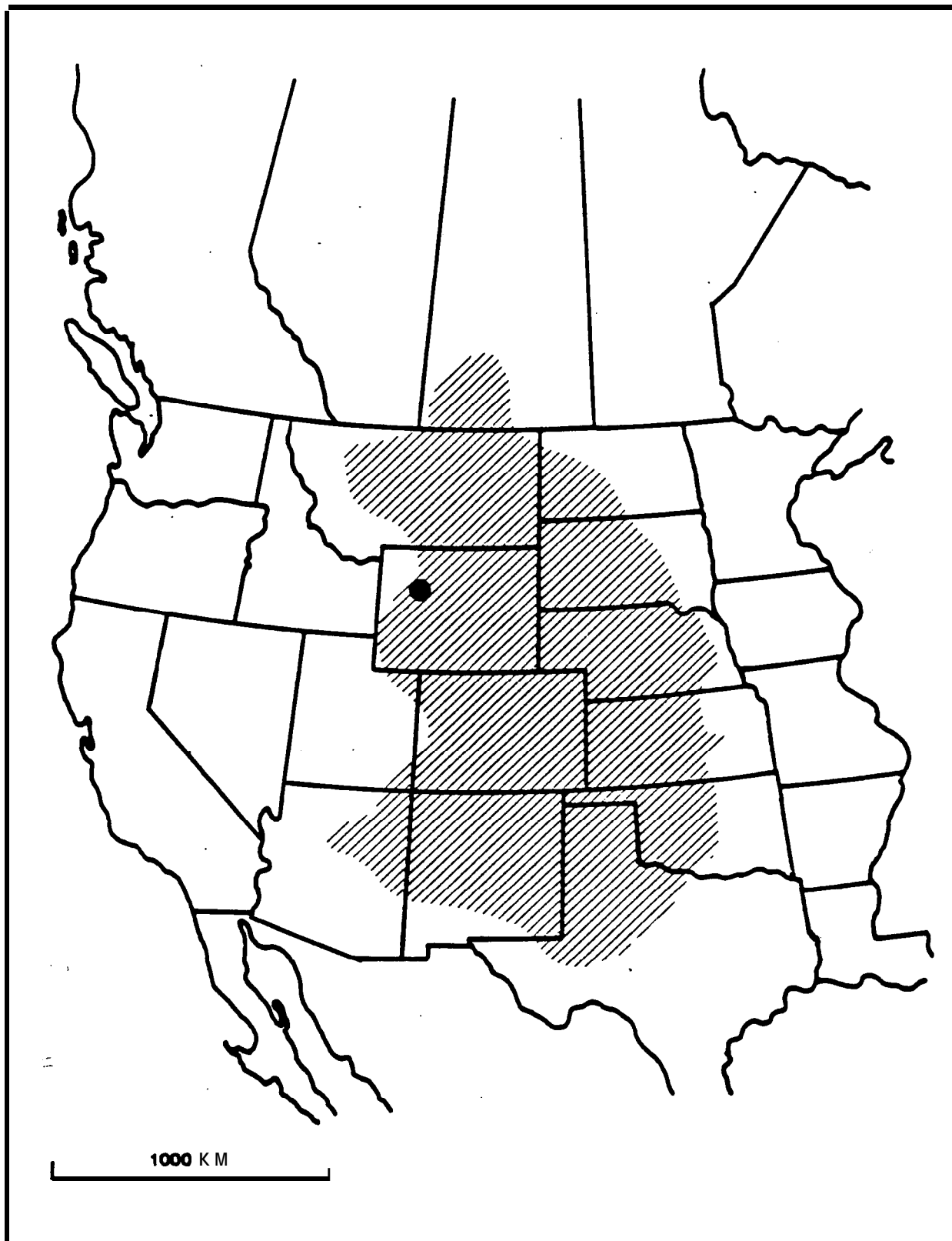


Figure 1: Historical range (shaded) and last known current range (dot) of the black-footed ferret. Anderson et al. 1986.

former range. In the period 1916 to 1920, prairie dogs were poisoned over a combined total of **47,000,000** ac (**19,000,000** ha; some of this was retreatment of areas poisoned in preceding years) in Colorado, Montana, New Mexico, North Dakota, South **Dakota**, and Wyoming (Bell 1921). Various estimates suggest a reduction of 90-95 percent of historically occupied prairie dog area from the 1900's to the present (Choate et al. 1982, Anderson et al. 1986, Flath and Clark 1986, Fagerstone in press). Remaining prairie dog colonies were smaller and frequently more isolated. Montana prairie dog colonies in 1910 were both larger and nearer to adjacent colonies than today, with a high degree of nonrandom aggregation (Flath and Clark 1986). Given rates of prairie dog eradication elsewhere, this was probably typical for most areas where prairie dogs occurred. The conclusion that ferret decline was linked to this rapid decline and fragmentation of prairie dogs has been reached by several investigators (**Seton** 1929, Cahalane 1954, Linder et al. 1972).

In the **1950's**, the general impression of biologists was that the species had a broad distribution occurring in low densities throughout the former range, although no populations of ferrets were studied. Of the approximately 130 counties and provinces where ferrets had been found since 1880 (Anderson et al. **1986**), only 10 were recorded to have ferrets by the 1960's. Ferret specimen collections dropped from an average of 9.1 specimens/year during the peak period of collection from 1920 to 1930, to less than 2.5 specimens/year from 1950 to 1960 (Anderson et al. 1986).

South Dakota. 1964-1980

Discovery of a black-footed ferret found on a farm in Mellette County, South Dakota, in August 1964 precipitated studies that covered 11 years (**Hillman 1968**, Henderson et al. 1969, Sheets 1970, Linder et al. 1972, Fortenbery **1972**). Some 90 black-footed ferrets were located, with a total of 38 young **produced** in 11 litters (Linder et al. 1972). Extensive surveys indicated a highly dispersed, low density population of ferrets distributed in at least eight counties (approximately 7,700 mi² or 20,000 km²), closely corresponding to the highest prairie dog concentrations in the State (Henderson et al. 1969).

By 1971, investigators were unable to locate additional ferrets, reproduction was not filling **adjacent** open habitat, and relationships with landowners were deteriorating (**Hillman** and Linder 1973, **Hillman** and **Wentz** 1985). In 1971, six ferrets were caught in the wild and moved to the U.S. Fish and Wildlife Service's (Service) Patuxent Wildlife Research Center in Laurel, Maryland, for captive propagation (Erickson 1973, Carpenter 1985). Four of these animals died after inoculation with a modified live virus vaccine to prevent canine distemper (Carpenter et al. **1976**), a disease which is now known to be **100** percent fatal to black-footed ferrets (Carpenter et al. 1976, Williams et al. in press). Through 1974, three more animals were brought to the Research Center. Ferret kits were born in 1976 and 1977 to 1 of 2 females, but the 10 young were either stillborn or died within days (Carpenter 1985). The last remaining captive animal at Patuxent died in 1979 (Carpenter 1985).

The black-footed ferret was given legal protection under the Endangered Species Preservation Act (P.L. 89-699) in 1967, the Endangered Species Conservation Act (P.L. 91-135) in 1970, and the Endangered Species Act (Act; P.L. 93-205) in 1973 (see Cole in press for a summary). In 1974, the Service established a Black-footed Ferret Recovery Team to develop a recovery plan. Search efforts of varying degrees of intensity continued elsewhere within the former range (Lewis and Hassien 1974, Clark 1978, **Jobman** and Anderson 1981a, Clark and Campbell 1981). No additional ferrets were seen in Mellette or any of the adjacent counties where they had been observed in the previous 10 years (**Hillman** and Wentz 1985). Discoveries of ferret skeletal material (Clark and Campbell 1981, Martin 1983) expanded the known range of the black-footed ferret, but no live ferrets were found. In the interim, the black-footed ferret was declared extirpated in Texas, Oklahoma, and Canada (**Jobman** and Anderson 1981b, Thornbach and Jenkins 1982).

Wyoming. 1981-1984

In September 1981, a ranch dog killed a black-footed ferret near Meeteetse, Wyoming, leading to discovery of a nearby population (Schroeder and Martin 1982). Black-footed ferrets were found distributed among approximately 7,400 ac (3000 ha) of white-tailed prairie dog colonies in an area of approximately 77 mi² (200 km²) (Forrest et al. 1985a, Clark et al. 1986a). Research found that some ferret sign, previously thought to be present throughout the year, only occurred seasonally (Clark et al. 1984a, 1984b). Spotlighting and snow-tracking were used to describe ferret abundance and distribution (Campbell et al. 1985, Richardson et al. 1985). Techniques to radio-monitor selected black-footed ferret individuals were developed and used (**Biggins** et al. 1985, 1986), resulting in detailed movement data and corroboration of other observational field data. Techniques to safely capture, handle, and tag black-footed ferrets were developed (Thorne et al. 1985, Fagerstone et al. 1985, Fagerstone and Johns 1987) and used to support population estimates made by snow-tracking and spotlighting.

In all, 186 black-footed ferret young were produced from 1982-1984. Total population estimates were 88 (28 adults) in 1983 and 129 (43 adults) in 1984 (Forrest et al. in press). Population estimates based on mark/recapture techniques gave nearly identical results; 95 black-footed ferrets in 1983 and 128 in 1984 (Forrest et al. in press). Black-footed ferrets never were found beyond 6.8 mi (11 km) from the periphery of the primary study area (Forrest et al. 1985a), or elsewhere in Wyoming during this time. Black-footed ferret skulls were found in Blaine and Carter Counties, Montana, in 1983 and 1984, but no live ferrets were found (Anderson et al. 1986).

In February 1982; the Service designated the Wyoming Department lead agency on ferret recovery in Wyoming. The Wyoming Department in turn established a Black-footed Ferret Advisory Team to advise it on ferret management and research. The Advisory Team's role was supplemented by a temporary ad hoc advisory committee established to study the feasibility of captive breeding following a meeting hosted by the Wyoming Department in April 1984. The meeting was attended by the New York Zoological Society, the Wildlife Preservation Trust, the Service, and Biota Research and Consulting- (a private

conservation research group). The **committee** returned with a **recommendation** in September 1, 1984 to initiate captive breeding as soon as possible (Anderson et al. 1984). The Wyoming Department initiated steps to obtain approval and funding and to locate adequate facilities and staff. A black-footed ferret workshop, which addressed current research and management, was held at the University of Wyoming in September 1984 (Anderson and Inkley 1985).

Wyoming, 1985-1987

A decision to remove ferrets from the population in the fall of 1985 for captive propagation was reached in a meeting between the Wyoming Department and the Service in May 1985. In June 1985, **Yersinia pestis** (the causative agent for sylvatic plague), a pathogen to which prairie dogs are highly susceptible, was identified from flea samples in the Meeteetse complex (Fagerstone and Biggins 1986). Plague was eventually identified in 9 of the 18 colonies regularly occupied by black-footed ferrets (Fagerstone and **Biggins** 1986). Dusting with carbaryl to kill the flea vector of the disease began in July, and through August some 6,200 ac (2,500 ha) were treated. The plague epizootic reduced formerly occupied prairie dog colonies by about 20 percent (Fagerstone and **Biggins** 1986). The treatment temporarily reduced the number of fleas present, but pretreatment flea levels were reached within a month after treatment (Fagerstone and **Biggins** 1986). Plague was widespread in the Meeteetse complex in 1986 (**Menkens** and Anderson 1987) and **still was** present in 1987.

By August 1985, low population counts and sudden disappearance of black-footed ferret litters suggested a potential problem with the ferrets also (Forrest et al. **1985c**, Clark et al. 1985b). The problem was diagnosed when two of six ferrets brought to the Wyoming Department's Sybille Wildlife Research and Conservation Education Center in October to form the nucleus of a captive founder population died of canine distemper which could only have been contracted in the wild (Williams et al. in press, Thorne and Belitsky in press). Because the original group of black-footed ferrets had been housed together, all contracted distemper and died within 70 days (Williams et al. in press). Population estimates in 1985 went from 58 in August to 31 in September and to 16 in October. Six additional ferrets (four females and two males) were removed from the wild from October 26 to November 2 (Forrest et al. in press, Thorne and Belitsky in press), after which approximately six individuals remained in the wild (Forrest et al. in press).

Captive breeding was attempted during the winter of 1986 but was not successful (DonCarlos et al. in press). A need for an additional reproductive male was demonstrated, as only one of the two males appeared capable of breeding (DonCarlos et al. in press). In the summer of 1986, five adults and two litters were found (Morkill et al. 1987). **-Analysis** of the ferret population and other carnivores collected in the Meeteetse area indicated that distemper was widespread among species and throughout the area before 1986 but was apparently not active in 1986 (Williams 1987). One male ferret was immediately brought into the breeding program. An evaluation of the remaining ferret population indicated that the population was at risk of extinction (Wyoming Game and Fish Department 1986). This viewpoint was supported by

specialists (e.g., Maguire in press) attending a workshop on small population biology and reproductive physiology of mustelids held at the University of Wyoming in August 1986 (Seal et al. in press). Most of the remaining wild ferrets were trapped in September 1986, bringing the captive total to 17 individuals (6 males, 11 females). One additional male remaining in the wild was captured in February 1987 (Morkill et al. 1987).

Following establishment of the captive population in 1985, the Captive Breeding Specialist Group of the International Union for Conservation of Nature and Natural Resources was asked by the Wyoming Department and the Service to serve as a technical advisory **committee** to the captive breeding **program**. A captive breeding facility funded by the Service and the Wyoming **Department** to be managed by Wyoming was partially completed at the Sybille Wildlife Research and Conservation Education Center in December 1986 (Thorne 1987). The Center was staffed by a research veterinarian in January 1987. Two litters were born in late June and early July 1987, marking the first recorded success for propagating this species in captivity. Fifty-eight ferrets (seventeen wild-caught and forty-one captive-reared) resided in captivity as of July 1988.

Problem Analysis and Recovery Strategies

Successful recovery of the black-footed ferret requires resolution of problems at a number of steps, beginning with captive propagation (Richardson et al. 1986). As in all ecology management, uncertainty pervades the recovery process but should not impede it (Gates 1973, Soule 1986, Clark and Cragun in press). Decision making can be improved and uncertainty reduced by modeling the variability surrounding complex decisions (risk assessment), designing actions as experiments (to identify causal relationships), using available natural history information (including knowledgeable individuals and extensive literature reviews), and identifying cumulative effects of activities (Orians et al. 1986).

The cost-effectiveness of alternatives must also be considered. For example, Cole (in press) indicated that 1.5 million dollars had been expended by the Service on black-footed ferret-related research and management from 1982-1986; contributions from the private conservation sector totaled 0.5 million (T.W. Clark pers. **comm.**). In the future, the less dependent on external maintenance black-footed ferrets are, the less likely they are to be affected by the vagaries of budgets and growing **commitments** to other species. Strategies which offer the lowest-future maintenance costs for black-footed ferret survival should be given the highest consideration.

Problems and Strategies:

Findings and monitoring black-footed ferrets

Guidelines for conducting ferret searches to use on future development areas were developed from 1980 to 1985 and approved by the Service in 1986 (U.S. Fish and Wildlife Service 1986, Appendix I); techniques were described by Clark et al. (1984a, 1984b). Under Section 7 of the Act, Federal agencies

that propose actions which may affect potential ferret habitat (prairie dog colonies) must consult with the Service to determine whether surveys for ferrets are necessary. Surveys also may be necessary on public and private lands which propose the use of strychnine baits to control prairie dogs (Environmental Protection Agency 1987, Appendix II). Individuals leading survey teams must complete a workshop course in search techniques before they are approved by the Service. Although Section **7-mandated** searches are important tools for finding new ferrets, they have never been part of an organized and prioritized search plan. Past search efforts have never been collated, so searches may have missed some habitat or may have been duplicated elsewhere.

Although search techniques have improved, low-intensity methods for verifying ferret presence have not been developed. Scent attractant tests were inconclusive (Clark and Campbell 1983, **Hammer** and Anderson 1985), and fecal bile analysis of black-footed ferret and other mustelid scats with thin-layer chromatography could not discriminate black-footed ferret scat from that of other species (Johnson et al. 1986). Gas chromatography may prove more useful than thin-layer chromatography to assay scats, and scents derived from **black-footed ferrets** **may be** more effective in luring black-footed ferrets than synthetic scents or those of other species.

Locating additional **populations of** black-footed ferrets would add valuable genetic stock to the existing founders and could provide the opportunity to gather additional biological data on free-ranging animals. However,, the probability of finding remaining black-footed ferret populations before they become extinct diminishes each year ferrets are not found. Exponential decay rates of black-footed ferret populations known historically compared to populations known today gives the ferret a population "half-life" of only 13 years (Brussard and **Gilpin** in press). The success or failure of captive propagation and reintroduction will determine the relative urgency for additional ferret stock. A large investment in searches could even be counterproductive if it diverts resources from important tasks such as habitat inventory.' Using decision analysis, Maguire et al. (in press) found that although actively searching for wild ferrets (rather than just responding to unsolicited reports of sightings) would improve the prospects for finding and maintaining wild ferrets, the probability of finding ferrets in the wild would still be very low. Allocating resources available for ferret recovery to locating and protecting suitable habitat for reintroduction may be a more efficient use of limited funds.

Monitoring reintroduced ferrets or other new-found populations will be extremely important. Spotlight censuses (200 **man-days/summer**), mark/recapture (80 man-days/fall) and snow-tracking (60 man-days/winter; Meeteetse averages from 1982-1985) are manpower-intensive (Forrest et al. in press, Richardson et al. 1987). Radiotelemetry required an additional 1800 man-days for a portion of one fall season (Forrest et al. in press). If future maintenance costs are to be minimized, less labor-intensive methods which yield data of comparable precision need to be developed. For example, black-footed ferret diggings and tracks are visible from fixed-wing aircraft (**Biggins** and Engeman 1986), allowing one person to cover extensive areas. Noninvasive "sight"-recapture models to generate snow-tracking or spotlighting population estimates with confidence intervals 'should be articulated (**Minta** and Mangel unpubl.).

Habitat

Control or extermination of prairie dogs has had an important influence on ferret endangerment. The approval of strychnine for use in prairie dog control (Environmental Protection Agency 1987) and use of phostoxin gas in several States are two indicators of an aggressive, ongoing program of prairie dog control. Direct reduction in the area occupied by prairie dogs has been shown to reduce the number of black-footed ferrets linearly (Forrest et al. 1985a) and increases distances between colonies, which limits or eliminates opportunities for natural dispersal and recolonization. Individual prairie dog control projects have never been evaluated for their cumulative effects on black-footed ferret habitat at the regional or State level; reduction of prairie dogs therefore continues to threaten black-footed ferrets. Conversely, expansion of prairie dogs would probably benefit ferrets. Based on estimated habitat requirements, ferrets require a commitment of less than 0.03 percent of our public rangelands to provide them adequate habitat (Flesness in press), with few conflicts with other surface users (Clark 1986).

A regional inventory of available black-footed ferret habitat is essential. Without a regional inventory, the cumulative effects of control projects cannot be known and, therefore, rational approaches to protecting appropriate habitat cannot be formulated. Hillman et al. (1979) and Forrest et al. (1985a) suggested habitat management guidelines for ferrets based on their respective South Dakota and Wyoming experience. These data were used as the basis for two habitat inventory models developed to date (Houston et al. 1986, Miller et al. in press). A consensus about what constitutes habitat criteria on a regional basis needs to be reached so that reintroduction sites can be evaluated and ranked by some agreed-upon criteria.

Montana completed such an inventory utilizing a State Working Group composed of Bureau of Land Management; Montana Department of Fish, Wildlife and Parks; Bureau of Indian Affairs; the Service; Forest Service; Montana Department of Agriculture; and Biota Research and Consulting personnel using the Houston et al. (1986) model (Clark et al. 1987). Four recovery areas were identified, ranging in size from 3730 ac (1510 ha) to 7775 ac (3147 ha; Clark et al. 1987). Locating, identifying, and evaluating sites took 3 years and included informal and formal group meetings with concerned landowners (Flath and Clark 1984). Evaluation was aided by a multistage inventory with increasingly detailed evaluation as the choices of sites became narrower. Several States (Wyoming, North Dakota, and Utah) have inventories underway of prairie dogs as black-footed ferret habitat (S. Anderson pers. comm., R. Crete pers. comm.). All States within prairie dog range must be encouraged to participate in this effort so the scope and availability of ferret habitat can be fully ascertained and objectives properly established.

The two existing habitat models both recognize the importance of complex size, a complex being defined as "a group of prairie dog colonies distributed so that individual black-footed ferrets (and thus genetic material) can migrate among them commonly and frequently" (Forrest et al. 1985a). Because it is difficult to census prairie dogs, areas of prairie dog colonies are used rather than actual prairie dog counts, even though prairie dog population

numbers vary from colony to colony and between species (King 1955, Koford 1958, Forrest et al. 1985a). Black-tailed prairie dogs tend to be more gregarious and, therefore, occur in more densely populated colonies. Ferrets have been shown to occur at densities of 99-148 ac (40-60 ha) per adult black-footed ferret at Meeteetse (1 litter/124 ac or 50 ha), which are white-tailed prairie dog colonies, and 75 ac (30 ha)/black-footed ferret litter in South Dakota, which are black-tailed prairie dog colonies. An implicit assumption of these models is that prairie dogs within these areas are produced under a sustained yield to ferrets and other predators. One model which tests that assumption (Stromberg et al. 1983) gives area requirements 50 percent to 100 percent larger than those observed in the field. The ability of various habitats to contain populations of a given size will only be known from the results of reintroductions, but at present it appears that large complexes are necessary to provide areas suitable for viable ferret populations.

Because small prairie dog colonies have a value to black-footed ferret populations only when they are found with a sufficiently large aggregation of other colonies, only those prairie dog colony complexes with specific attributes relevant to black-footed ferrets need to be identified. We can disregard, for the purposes of ferret recovery, prairie dog colonies that are unsuitable for reintroduction. Prairie dogs have no doubt benefitted from a decade of attention focused on black-footed ferrets, however limited in scope. Although prairie dogs have their own intrinsic value, black-footed ferret and prairie dog management must be separated. Protection of those existing habitats with value to black-footed ferrets needs to be emphasized, allowing removal of black-footed ferret-related restrictions from other areas, and setting targets for development or enhancement of habitats where they may be appropriate or desired in other areas.

Surface disturbance to prairie dog colonies should be evaluated on a case-by-case basis (Clark 1986). Black-footed ferrets at Meeteetse exhibited no avoidance of pumping oil wells, roads, storage tanks, or other oil field activities (Biggins et al. 1985), although vibroseis exploration techniques did have short-term effects on survival of prairie dog young (Young and Sawyer 1981, Menkens and Anderson 1985). Surface alterations created by roads and subsequent increased human pressure from traffic, shooting, and domestic dogs may be more harmful, yet alliances with sportsmen groups could provide the basis for mutually beneficial protection for large areas of prairie dogs. Many agricultural practices are compatible with black-footed ferret and prairie dog management, so long as prairie dogs are tolerated. In general, grazing by livestock and wild ungulates should be regarded as an important positive tool in prairie dog management; it may be essential where range vegetation grows rapidly (Koford 1958, Smith 1958).

Sylvatic plague, which was documented at Meeteetse in 1985, may play a significant role in prairie dog reduction and black-footed ferret habitat disruption (Hubbard and Schmitt 1984). The effects of plague can be devastating (Rayor 1985); 610,000 ac (247,000 ha) of Gunnison's prairie dogs died in plague epizootics in Colorado from 1945-1947 (Armstrong 1972). Plague is likely found throughout the range of prairie dogs today (Barnes 1982), although the flea species which serve as vectors of the disease may have

discrete distributions (Fagerstone and **Biggins** 1986). Plague is of sufficient importance to incorporate prairie dog colony extinction rates into the planning process for the black-footed ferret. More information on the ecology and management of plague in prairie dogs is needed.

Disease

Canine distemper has compromised both black-footed ferret captive breeding programs and decimated the Meeteetse population to the point of collapse. The origin of the disease in North American wildlife is obscure (Budd 1981). There is some evidence that canine distemper was introduced within recent history (Gorham 1966); the introduction of domestic dogs following European settlement of the Great Plains provided one avenue for ready contact and spread of the disease if it was not already present in Indian dogs or other wildlife. In either case, ferrets had numerous opportunities to recolonize locally decimated populations from abundant habitats nearby. Because of black-footed ferret sensitivity to canine distemper, and the ubiquitous presence of distemper in other wildlife (Budd 1981, Williams **1982**), black-footed ferret populations have a high probability of exposure to epizootics of the disease. It is likely that distemper and other diseases will continue to have profound effects on isolated wild populations of ferrets so that no single population will be safe from extinction.

Captive populations are also at risk from diseases that could be transmitted rapidly in confinement despite safeguards and will require several separate facilities to ensure their protection. It is extremely important to duplicate captive facilities at the earliest possible date. Several facilities will provide not only an opportunity to avoid total extinction of the species from disease in captivity, but the greater the number of additional facilities, the less the effect on genetic diversity of the species if one population is lost. The use of several **facilities**, however, will increase the likelihood of an introduction of enzootic diseases into the collective **captive** and reintroduced populations and increase the opportunity for catastrophic epizootic diseases in individual captive breeding facilities unless stringent disease prevention measures are applied.

Management of disease in free-ranging black-footed ferrets is problematic. The costs of intensive monitoring to detect incipient disease outbreaks and the expense of intervention in an ongoing epizootic are probably higher than the costs of restocking a population which has become extinct. Current captive practices require booster inoculations against canine distemper every 3 to 6 months following three initial inoculations at t-week intervals to ensure the presence of antibody (E.T. Thorne pers. **comm.**). Management required to prevent disease in the wild by prophylactic means could therefore be intense. This could change with additional information on disease distribution and transmission, vaccines, and dynamics of disease among black-footed ferrets and their close Eurasian relatives. Analysis of uninterrupted epizootics in reintroduced populations would provide opportunities for research into habitat configurations or social conditions that might influence spread of the disease. Although eliminating diseases may be impossible, reducing the probability of introduction, transmission, and resulting

mortality could prove feasible. Greater knowledge about the ecology of disease relating to black-footed ferrets in its North American habitat could make future efforts to manage disease more cost effective than restocking. Until that time, it can be argued that disease management in wild, reintroduced populations should be given low priority.

Small Population Size

The founder population at Sybille, which includes all known black-footed ferrets, is small. At very low population numbers, any one of several intrinsic (a part of the species' biology) or extrinsic (influenced by the external environment) factors can lead to extinction (Soule and Simberloff 1986). These factors include demographic stochasticity (changes in fitness or survival of population subgroups), environmental stochasticity (diseases, changes in predator or competitor densities) of which catastrophes (fire, hurricanes) are one extreme case, and the effects of inbreeding and the loss of genetic variation through drift (genetic stochasticity) (Shaffer 1981). Brussard and Gilpin (in press) summarize the species population response as resilience (an ability to recover from declines resulting from random variation in normal birth and death events and environmental perturbations) and fitness (having appropriate set of genes to maintain normal fecundity and viability under the prevailing environmental circumstances). "Beyond this, a population's long-term survival potential is related to its adaptability, or its ability to evolve" (Brussard and Gilpin in press). The latter two concerns are determined by the presence of sufficient genetic variation, or heterozygosity.

Black-footed ferret populations must be large enough to accommodate variations in their demography and environment that tend to draw them toward extinction in the short term (Gilpin and Soule 1986), as well as large enough to preserve existing heterozygosity and provide the potential for species evolution. Population sizes necessary to avoid extinction based on viability analysis of these causes differ and, therefore, provide a range of management strategies for black-footed ferret recovery. Recovery could be accomplished by managing a single large black-footed ferret population or managing many small black-footed ferret populations (Soule and Simberloff 1986) as a single "metapopulation" (Levins 1970). Geneticists generally agree that populations require an effective size (N_e) on the order of 500 breeding individuals to retain genetic heterozygosity sufficient for evolution (Franklin 1980, Frankel and Soule 1981, Lande and Barrowclough 1987). N_e is the size of an idealized population that loses genetic diversity at the same rate as a particular real population. The idealized population is one in which all individuals mate randomly, equal numbers of each sex occur, the number of young produced by individuals are Poisson distributed, and there are no overlapping generations (Frankel and Soule 1981). Departures from N_e are multiplicative, and, as a result, the census population (N) usually must be larger to maintain an N_e of a given size. Groves and Clark (1986) calculated an N_e/N ratio of about 0.25 for black-footed ferrets. Lacy and Clark (in press) found N_e/N ratios between 0.2 and 0.4 (0.5-1.0 of the total population), and Ballou and Oakleaf (1987) estimated an "optimistic" N_e/N ratio of 0.3 to 0.5. Most populations of captive propagated mammals seldom exceed N_e/N ratios of 0.3 (N.R. Flesness

pers. comm.). N_e/N ratios in captivity can optimistically range higher because the effects of unequal breeding sex ratio and variance in family size can be manipulated (Ballou and Oakleaf 1987, Frankel and Soule 1981). For black-footed ferrets in captivity, the number of breeding adults is assumed to be half of the N_e , but in the wild it is **more likely** to be lower than **one-third** of the census number of prebreeding animals.

Retention of genetic diversity will be maximized if: (1) all founders are represented, (2) all founders are represented equally, and (3) the reproductive potential of the founders is maximized (Carson 1983, Ballou in press). Genetic variation in black-footed ferret founders is low (O'Brien et al. in press). What founder representation remains can be maximized by increasing black-footed ferret numbers as quickly as possible (to lose as little of the representation as possible), by producing sufficiently large numbers of young from each founder to ensure survival of representation into future generations, and by giving founders greater opportunities to contribute all of their genetic material. From a logistical standpoint, this also will allow captive ferret populations to reach reintroduction levels more quickly and reduce the number of generations in captivity. Ballou and Oakleaf (1987) estimated an N_e of 250 ferrets would maintain 80 percent of the original genetic heterozygosity for 200 years based on the first 17 ferrets in the Wyoming program. The objectives reflect maintenance of an obtainable level of heterozygosity within an agreed-upon management horizon (Foote in press), although a consensus of geneticists **recommends** that 90 percent retention of genetic diversity for 200 years is a more appropriate objective (Soule et al. 1986). An N_e of 1,500 black-footed ferrets would allow 90 percent retention of present diversity in black-footed ferrets (Ballou and Oakleaf 1987), which will be possible if wild populations are reestablished.

To survive extinctions due to demographic and environmental variation, Groves and Clark (1986) calculated that a census population of 40 ferrets could **persist** for 1000 years. Brussard and Gilpin (in press) pointed out several major problems with this calculation, suggesting the time to extinction was much shorter. Harris et al. (in press) found that populations of 120 to 150 were needed to ensure a **95-percent** chance of persistence for 100 years where some environmental **variation existed**. A population this size would be approximately 30 percent adults (Forrest et al. in press), or equivalent to a prebreeding census population of 24 to 45. As Harris et al. (in press) suggest, local populations of a census size of 30 could have a better than **80-percent** chance of persistence through 100 years barring extreme environmental variance. However, their model predicts that **all** black-footed ferret populations averaging 24 to 45 are likely to go extinct within 100 years, even under total protection.

Larger populations will allow greater opportunities for natural biological and evolutionary development to occur and are more likely to survive variability in their demography and environment. The theoretical option requiring the least demographic management of the black-footed ferret is a single contiguous population configured to ensure that genetic and demographic flows are **self-regulated** (Brussard and Gilpin in press). However, local extinctions from disease in either the prairie dogs or the ferrets themselves must be expected.

Because environmental variability effects of this magnitude are not damped by even fairly large increases in N (P. Brussard pers. **comm.**), several populations which have environmental variability independent of each other will be needed.

There is much support for a metapopulation approach for black-footed ferrets (Forrest et al. **1985a**, Richardson et al. 1986, Ballou and **Oakleaf** 1987, Clark et al. 1987, Lacy and Clark in press, Brussard and **Gilpin** in press, Harris et al. in press), based on our assumptions about available habitat and the potential for disease. To effectively manage black-footed ferrets as a metapopulation will require more precise estimates of the persistence of reintroduction "patches" to establish how many patches are appropriate. At present, the number of populations of black-footed ferrets necessary to provide probabilities of survival from chance environmental extinctions of both prairie dogs and ferrets has not been modeled. Ballou and **Oakleaf** (1987) suggest that a metapopulation of five subpopulations will retain greater allelic diversity than a single captive population. Lacy and Clark (in press) suggest that the amount of allelic diversity retained in 10 populations is substantially greater than in 5 populations. Brussard and **Gilpin** (in press) **recommend** 20 or more populations of a prebreeding census size of 100 each (about twice the size of the Meeteetse population) based on an N_e of 500 and an N_e/N ratio of 0.25. If the N_e/N ratios are in actuality higher, then both the size of individual colonies and the total number needed could be lower.

If the effective population size is to be maintained among many smaller populations, then exchange of genetic material at the rate of one individual/generation between local populations to ensure random and adaptive divergence among populations is necessary (Avery 1978, Lacy and Clark in press). Less than one individual/generation will result in a divergence of lines and more than one individual/generation will result in a more **uniform metapopulation** (B. Lacy pers. **comm.**). The artificial migration of genetic material between subdivided populations is very important in guiding the recovery strategy, because reintroduced populations that are expected to become extinct should probably not contain genetic material that is unique to the species. Unless genetic flows can be self-regulated (as they would be in large, contiguous populations), - genetic maintenance of reintroduced populations will be required indefinitely.

Serious consideration should be given to protecting and developing the largest sites possible. A prebreeding census population of 1500 free-ranging ferrets could support an N_e of 500, or approximately the population size necessary for maintenance of existing black-footed ferret genetic diversity. A population this size would require 185,000 ac (75,000 ha) of prairie dogs based on Forrest et al.'s (1985a) habitat data. Maintenance of a few large sites should not preclude other types of smaller-recovery areas (for fulfilling National or State objectives) to contribute to the overall recovery objective. The strategy pursued should reflect the maximum potential to preserve secure ferret numbers in the wild.

PART II

RECOVERY

STEPDOWN OUTLINE

OBJECTIVE: To ensure immediate survival of the black-footed ferret by:

- (1) Increasing the captive population of black-footed ferrets to a census size of 200 breeding adults by 1991;
- (2) Establishing a breeding census population of 1500 free-ranging black-footed ferret breeding adults in 10 or more populations with no fewer than 30 breeding adults in any population by the year 2014; and
- (3) Encourage the widest possible distribution of reintroduced black-footed ferret populations.

1. Ensure reproductive success and survival of captive black-footed ferrets.

11. Minimize the potential for disease outbreaks and **catastrophies** in captivity.

111. Establish five captive populations located in at least three separate geographic locations to avoid catastrophic loss at a single facility.

1111. Develop a rationale for selection of animals for transfer to new captive populations.

1112. Identify facilities and divide the population.

1113. Develop a Species Survival Plan or Master Plan.

1114. Monitor, advise, schedule, and enforce permit requirements of participants.

112. Establish protocols for disease prevention.

113. Develop a disease outbreak contingency.

114. Develop transfer protocol.

115. Study disease resistance.

1151. Investigate efficacy of canine distemper vaccines.

11511. Investigate new modified live vaccine.

- 11512. Investigate bioengineered vaccine.
- 1152. Document and study other diseases of **black-footed** ferret as they occur.
- 12. Breed black-footed ferrets using strategies that preserve at least 80 percent of the original genetic diversity of founding animals for 200 years.
 - 121. Maximize reproductive output to a population of 200 breeding adults early in the breeding program.
 - 1211. Capture additional animals found at Meeteetse.
 - 1212. Ensure all individuals are involved in contributing genetic material.
 - 1213. Use artificial means to capture the genetic contribution of individuals who will not reproduce by natural means.
 - 12131. Improve electroejaculation techniques.
 - 12132. Perfect artificial insemination techniques.
 - 12133. Develop embryo transfer techniques.
 - 1214. Improve breeding strategies.
 - 12141. Characterize female estrus.
 - 12142. Characterize male spermatogenesis.
 - 12143. Study ways to induce reproduction.
 - 12144. Investigate methods to determine pregnancy.
 - 12145. Investigate ways to terminate pseudopregnancy.
 - 1215. Incorporate wild black-footed ferrets from geographic areas other than Meeteetse into the breeding program (see Task 345).
- 122. Maximize retention of founder alleles in F1 and subsequent generations.
 - 1221. Minimize genetic relatedness among mates.
 - 1222. Make every effort to ensure at least seven offspring from each founder pair reproduce in subsequent generations.

- 1223. Utilize the genetic contribution of the original 18 wild-caught ferrets as long as possible.
 - 12231. Develop techniques for cryopreservation of black-footed ferret semen for use in artificial insemination of future generations.
 - 12232. Research cryopreservation and in vitro fertilization of ferret ova.
- 1224. Ensure effective migration of the genetic material between facilities to maintain heterozygosity.
- 123. Evaluate fitness, genetics, and demography of the captive population.
 - 1231. Evaluate genetic diversity at the nucleic acid level and its potential contribution for monitoring the breeding program.
 - 1232. Keep records on all individuals.
 - 12321. Identify individuals through permanent marks.
 - 12322. Maintain permanent records.
 - 12323. Adopt a duplicate record-keeping system.
 - 12324. Curate the collection of carcasses at each facility and centralize specimen records.
 - 12325. Collect and adequately store tissue samples from all dead ferrets.
 - 1233. Develop a program to evaluate individual characters.
- 13. Provide facilities for black-footed ferret reproduction and survival.
 - 131. Develop dietary protocol.
 - 1311. Understand nutritional and behavioral contributions of natural prey (prairie dogs) to captive black-footed ferret diet.
 - 1312. Study the contribution of diet to black-footed ferret reproduction.
 - 132. Develop lighting protocol.
 - 133. Develop husbandry protocol.

- 1331. Provide optimum breeding environment.
- 1332. Provide optimum whelping environment.
- 1333. Provide optimum rearing environment.
- 14. Maintain populations of surrogates to assist in rearing young and for experimentation where reproductive black-footed ferrets cannot be risked.
 - 141. Establish population objectives and management criteria for surrogates.
 - 142. **Establish** policies for use of nonreproductive black-footed ferrets.
- 2. Locate, evaluate, and maintain potential black-footed ferret habitat (prairie dogs) in North America.
 - 21. Define potential black-footed ferret habitat for recovery by 1988.
 - 22. Determine the distribution of prairie dogs defined as black-footed ferret recovery habitat in Task 21 by 1989.
 - 221. Map prairie dog colony complexes in each State.
 - 2211. Agree on standardized data collection.
 - 2212. Assign mapping responsibility and compile data.
 - 22121. Use existing data.
 - 22122. Conduct field surveys.
 - 222. Map the distribution of prairie dogs in Canada and Mexico.
 - 2221. Identify cooperators' in Mexico.
 - 2222. Identify cooperators in Canada.
 - 2223. Seek funding under Section 8 of the Endangered Species Act if sites in Mexico or Canada are found that could assist, in species survival.
 - 23. Develop a plan for ranking reintroduction sites and rank the top 20 candidate sites by 1989.
 - 24. Develop and implement monitoring and management prescriptions for the top 20 sites.

- 241. Develop and implement management plans for prairie dog colonies.
 - 2411. Identify all prairie dog colonies to be included in the complex.
 - 2412. Identify potential for prairie dog colony expansion.
 - 2413. Set **target** levels for the sizes of prairie dog colony complexes to be maintained.
 - 2414. Determine the potential impacts of plague and other disturbances to prairie dogs.
 - 24141. Determine patterns and occurrences of plague in the **immediate** geographic area of reintroductions.
 - 24142. Research plague impacts.
 - 241421. Determine distribution of flea vectors during disease outbreak and in enzootic conditions.
 - 241422. Assess the effects of plague on prairie dog population dynamics.
 - 2415. Plan and schedule manipulations of prairie dog populations.
 - 24151. Determine livestock use levels.
 - 24152. Identify techniques for increasing prairie dog populations.
 - 24153. Identify techniques for control of prairie dog populations.
 - 241531. Determine secondary effects of toxicants on black-footed ferrets.
 - 241532. Test nontoxic control methods.
 - 2416. Establish cooperative management agreements with public and private landowners.
- 242. Collect information on reintroduction sites for screening and baseline data purposes.
 - 2421. Conduct black-footed ferret surveys.

- 2422. Collect flea samples for plague.
- 2423. Document predator/competitor occurrence.
- 2424. Measure prairie dog population characteristics.
- 2425. Sample for presence of canine distemper.
- 243. Evaluate legal and procedural obligations at the State and Federal levels.
 - 2431. Determine obligations under NEPA.
 - 2432. Explore consequences of black-footed ferret designation as an "experimental population" under Section 10 of the Act.
 - 2433. **Recommend** to the Service a description of "core management areas" essential for black-footed ferret recovery.
 - 2434. Investigate obligations under Section **7** for habitat identified as a recovery area.
 - 2435. Investigate the development of policies for prairie dog management outside areas identified as potential or essential recovery areas for black-footed ferrets.
- 244. Provide protection for candidate sites.
 - 2441. Encourage changes in State statutes to prevent mandatory destruction of prairie dog colonies.
 - 2442. Acquire habitat.
 - 24421. Obtain **title**.
 - 24422. Obtain easements.
 - 2443. Model cumulative effects of prairie dog control on black-footed ferrets by State.
- 245. Initiate an information and education program for reintroduction sites.
 - 2451. Promote an understanding among land managers of the role of prairie dogs in prairie ecosystems.
 - 2452. Consider developing regional sociological profiles to support black-footed ferret reintroduction.

- 2453. Hold public meetings to discuss black-footed ferret reintroduction.
- 2454. Seek support from conservation and wildlife organizations.
- 246. Implement management plans and prescriptions and begin the monitoring program for the first three sites by 1989.
- 3. Locate additional populations of black-footed ferrets.
 - 31. Actively search for black-footed ferrets.
 - 311. Adopt a system for evaluating and prioritizing all new reports.
 - 312. Search for black-footed ferrets on a priority basis.
 - 3121. Use an historical data base to identify potential habitat where searches have not been conducted.
 - 3122. Respond to reports as they arrive.
 - 313. Conduct training workshops on updated search techniques for individuals and organizations.
 - 32. Solicit new black-footed ferret reports from the public.
 - 321. Offer a reward for information leading to the discovery of new ferret populations.
 - 322. Continue public information and education.
 - 33. Improve search efforts.
 - 331. Ensure the use of current Service search guidelines or their equivalent.
 - 3311. During the Section 7 consultation process for Federal activities, **recommend** ferret searches for those activities impacting black-footed ferret habitat (prairie dog colonies).
 - 3312. Ensure enforcement of Environmental Protection Agency label restrictions on rodenticide application prior to prairie dog control.
 - 3313. For private or State authorized activities, **recommend** black-footed ferret searches prior to activities that may impact ferret habitat.

- 332. Develop and improve survey techniques.
 - 3321. **Explore** potential for chemical attractants from captive **ferrets**.
 - 3322. Establish feasibility of gas chromatography, High Performance Liquid Chromatography (HPLC), and mass spectrophotometric methods for scat analysis.
 - 3323. Improve aerial surveys by simulation/testing.
 - 3324. Model predictability of spotlight detection under varying conditions.
 - 3325. Improve understanding of digging behavior by prairie dog hole plugging.
 - 3326. Test use of dogs' using scent combinations from captive ferrets and field trials.
- 34. Implement contingency plans if black-footed ferrets are located.
 - 341. Develop contingency plans for all States where black-footed ferrets could be located.
 - 342. Obtain the necessary State and Federal agreements and scientific permits to implement Tasks 343-346.
 - 343. When ferrets are located capture at least two (one male, one female), and, after an inventory of the population, capture an additional seven.
 - 344. Capture, handling, and shipment to captive breeding facilities and quarantine of captured ferrets should follow accepted protocol.
 - 345. Inventory the **newly** located ferret population **and cooperatively** develop **additional capture** rates within 1 year following the location of the new population.
 - 346. Develop management plans.
- 4. Begin **continuous** releases of black-footed ferrets into reintroduction sites when captive populations have reached or approach a sustainable census size of 200.
 - 41. Design release procedures.
 - 411. Prepare a reintroduction schedule.

- 4111. Prepare priority sites for reintroduction.
- 4112. Schedule black-footed ferret stock for release.
 - 41121. Develop an age and sex structure for release.
 - 41122. Determine **time of** year for release.
- 4113. Establish criteria for abandoning sites if releases fail after repeated attempts.
- 412. Develop conditioning techniques for captive populations and assess the need for conditioning prior to release..
 - 4121. Experiment with development of training skills.
 - 41211. Design and build training arenas.
 - 41212. Test methods to familiarize black-footed ferrets with prey and killing.
 - 41213. Test methods to train black-footed ferrets to avoid predators.
 - 4122. Adopt a training strategy.
- 413. Develop experimental designs for releases.
 - 4131. Develop criteria for using hard versus soft release techniques.
 - 41311. Review literature on releases.
 - 41312. Assess soft release equipment needs.
 - 4132. Determine needs for habitat modification.
- 414. Develop postrelease monitoring techniques for ferrets.
 - 4141. Improve radiotelemetry equipment.
 - 4142. Improve **censusing** techniques.
 - 4143. **Recommend** methods of individual identification.
 - 41431. Review ear tag designs.
 - 41432. Investigate body markings.
 - 41433. Retest transponders.

- 42. Conduct experimental releases of black-footed ferrets into the wild as the captive population approaches a census size of 200.
- 43. Evaluate reintroduction success and release techniques for the first three large-scale reintroductions.
 - 431. Census populations based on techniques developed in Task 4142.
 - 432. Investigate natality and mortality.
 - 433. Investigate emigration, **immigration**, and dispersal.
 - 434. Investigate home range and territoriality.
 - 435. Investigate interspecific interactions.
 - 436. Evaluate changes in habitat that occur following reintroduction (see Task 2421).
- 44. Operationally release black-footed ferrets, incorporating ongoing evaluation, until a prebreeding census population of 1,500 is established in the wild by the year 2010.
 - 441: Implement a greater reliance on translocated versus captive-reared stock for releases.
 - 442. Institute a program to ensure founders are represented in the release populations.
- 5. Manage reintroduced and other populations.
 - 51. Develop strategic management plans for reintroduced populations.
 - 511. Monitor black-footed ferrets.
 - 5111. Census populations annually.
 - 5112. Investigate emigration, **immigration**, and dispersal.
 - 5113. Refine existing population models.
 - 512. Establish protocols for demographic manipulation.
 - 513. Evaluate performance of genetic management.
 - 514. Establish policies for black-footed ferret disease management.
 - 5141. Investigate canine distemper ecology and epizootiology in carnivores within black-footed ferret range.

- 5142. Understand canine distemper dynamics by following outbreaks in reintroduced black-footed ferret populations.
- 5143. Explore ecological strategies employed by species of the subgenus Putorius to avoid species decline from canine distemper outbreaks.
- 5144. **Develop** single dose vaccine to **immunize** black-footed ferrets for canine distemper.
- 5145. Explore potential for widely distributed oral vaccines.
- 515. Establish policies for prairie dog disease management.
- 52. Enforce all laws protecting established populations.
- 53. Develop restocking contingency plans to translocate free-ranging black-footed ferrets to other populations.
 - 531. Develop criteria for determining which animals are "surplus" from free-ranging populations.
 - 532. Develop a procedure to contain the spread of disease between exchange populations.
- 6. Establish organizational arrangements to accomplish tasks and increase communication.
 - 61. Form advisory and technical groups to identify problems and solutions.
 - 611. Coordinate regional planning through the Black-footed Ferret Interstate Coordinating **Committee**.
 - 612. Encourage the formation of State working groups.
 - 613. Utilize a Captive Propagation Advisory Committee.
 - 614. Promote the exchange of scientific information and seek technical advice.
 - 6141. Encourage adequate outside peer review of proposals and research.
 - 6142. Continue to hold workshops relevant to current problems in black-footed ferret management and biology.
 - 62. Develop a national **constituency with** a long-term resource commitment toward the black-footed ferret.

- 621. Build local constituencies in each State within the **former** range of the black-footed ferret.
 - 6211. Ensure frequent publication of popular articles and updates in the media.
 - 6212. Ensure distribution of available films and educational materials.
- 622. Provide an opportunity for people to experience black-footed ferrets firsthand.
 - 6221. Develop education programs through captive facilities.
 - 6222. Establish a national wildlife refuge for grassland ecology.
- 623. Ensure national conservation organizations are frequently updated through personal contact.
- 624. Support the creation of a nonprofit organization with high credibility to focus attention on the species.
- 625. Support the Office of Technology Assessment's call for legislation to establish a National Biological Diversity Act.
- 63. Formulate a funding strategy for national black-footed ferret recovery by 1989.
- 64. Review program progress toward recovery objectives annually or biannually.

RECOVERY NARRATIVE

OBJECTIVE: To ensure immediate survival of the black-footed ferret by:

- (1) Increasing the captive population of black-footed ferrets to a census size of 200 breeding adults by 1991;
- (2) Establishing a breeding census population of 1500 free-ranging black-footed ferret breeding adults in 10 or more populations with no fewer than 30 breeding adults in any population by the year 2010; and
- (3) Encourage the widest possible distribution of reintroduced black-footed ferret populations.

The actions proposed to meet this objective will result in downlisting black-footed ferrets from endangered to threatened if the extinction rate of established subpopulations remains at or below the rate new subpopulations are established for at least 5 years. This objective should allow maintenance of 90 percent of existing black-footed ferret genetic diversity for 200 years and reasonable assurance of demographic stability if: (1) N_e/N ratios of 0.30 or more are maintained, (2) exchange of genetic material at the rate of one individual/generation occurs, and (3) 90 percent of reintroduced populations survive for 10 or more years. The total area required for downlisting is estimated at 185,000 ac (75,000 ha; 1,500 ferrets requiring 124 ac, or 50 ha, each among at least 10 populations) or larger. The mean recovery area size is, therefore, approximately 18,500 ac (7,500 ha). Because the distribution and dimensions of reintroduction areas are presently unknown, it is assumed that recovery areas both smaller and larger than this average will be identified. Sites should be stocked in order of suitability until the recovery objective is met. Although present data suggest that 10 populations will give a high probability of retaining most common or moderately rare genetic variants, more populations are likely to be required due to availability of habitat. As a cautionary note, small sites are likely to become extinct more rapidly than large sites due to environmental and demographic processes; sites large enough for continued biological and evolutionary change, or as close to that ideal as possible, are most stable. Additional populations above and beyond these national recovery objectives should be encouraged. Delisting criteria are deferred pending outcomes of reintroduction success and management experience.

Sensitivity of the black-footed ferret to canine distemper indicates that ferret populations in the wild will likely become extinct from time to time and will require restocking. Restocking and genetic exchange should be accomplished from wild populations through translocation where possible. If necessary, wild black-footed ferrets could supply captive breeding facilities with reproductive stock. It is presumed that some portion of the species' genetic variability will always be maintained in captive populations, although if panmixia is ensured through artificial migration, most of the species' variability will be represented in each of the wild populations. Reproduction objectives for captive facilities should be minimized once free-ranging populations become established and productive.

Recovery must be national in scope, requiring cooperation from all States and organizations that contain habitat or facilities important to ferret recovery. This implies that a strong coordinative and facilitative role by the Service is necessary. An Interstate Recovery Coordinating **Committee**, sponsored by the Service, will provide coordination, to a regional recovery effort to participating States. The Captive Breeding Specialist Group or a similar group should be encouraged to continue in an advisory capacity, and additional technical expertise should be **incorporated** when needed.

1. **Ensure reproductive success and survival of captive black-footed ferrets.**

Recovery will not be achieved unless black-footed ferret reproduction in captivity can provide a consistent flow of reintroduction stock to ongoing reintroduction programs. Maintenance of captive populations for reproductive stock will be necessary until populations in the wild reach an equilibrium of around 1,500 free-ranging adults. It is assumed that ferrets will be maintained in captivity for research and educational purposes indefinitely. Planning for the reproduction success and survival of captive black-footed ferrets has been previously developed by the Captive Breeding Specialist Group, the Service, and Wyoming Department (Wyoming Game and Fish Department 1987a).

11. **Minimize the potential for disease outbreaks and catastrophes in captivity.**

Captive populations have been lost to **catastrophes** (Dobson and May 1986). For the first 3 years of this plan, all known **black-footed** ferrets in existence will be in captive facilities; catastrophic loss is a major concern.

111. **Establish five captive populations located in at least three separate geographic locations to avoid catastrophic loss at a single facility.**

Epidemics could spread rapidly through a single facility despite safeguards. This risk can be reduced by using two or more facilities. The more facilities, the less critical the **loss** of a single facility is, although the chance for an introduction of enzootic and sporadic diseases is increased.

1111. **Develop a rationale for selection of animals for transfer to new captive populations.**

A logic for subdividing the captive population has been developed (Ballou and **Oakleaf** 1987, Appendix III). Given the evaluation of potential risks to a single, confined population, subdivision should proceed at the earliest possible time using this, or the most current, logic.

1112. Identify facilities and divide the population.

Selection of recipient facilities should be made in conjunction with the zoo **community**, Service, and Wyoming Department. Wyoming has developed a list of **criteria** and has solicited proposals for participants through the American Association of Zoological Parks and Aquariums.

1113. Develop a Species Survival Plan or Master Plan

The core breeding population, although distributed throughout several facilities, should be managed under similar management protocols. These may vary between institutions, but should be developed through a Species Survival Plan or other master plan. Coordination of all management activities will be the responsibility of the **Wyoming Department** and the Service. If appropriate, a coordinator could be appointed to implement the management plan.

1114. Monitor, advise, schedule and enforce permit requirements of participants.

It is the responsibility of the Service and Wyoming Department to approve and ensure compliance with plans or other management documents and to develop management agreements among facilities and agencies as required by Federal and State law. Because of permitting requirements, the Service and Wyoming Department should develop exchange policies and programs between facilities and agencies in accordance with their respective laws, regulations, and policies.

112. Establish protocols for disease prevention.

The Wyoming-Department has established a captive breeding and disease management protocol at Sybille which can serve as a model for other facilities (Appendix IV). A quarantine protocol al so should be published and implemented (see also Tasks **1211** and 1215).

113. Develop a disease outbreak contingency.

Guidelines for quick action in the event of disease outbreak in a facility (including evacuation, isolation, veterinary care, convalescence, disposal or use of tissues, and containment specific to several kinds of likely diseases) must be developed. These should be developed by each facility in conjunction with the Species Survival Plan or master plan.

114. Develop transfer protocol.

A plan detailing where black-footed ferrets will go, protocols for transport, and agreements with facilities to receive them should be established.

115. Study disease resistance.

Black-footed ferret disease resistance could aid in limiting the severity of epizootics in captivity and in small wild populations.

1151. Investigate efficacy of canine distemper vaccines.

Black-footed ferrets at Sybille are currently inoculated with a killed vaccine, which has produced antibodies in black-footed ferrets sufficient to indicate resistance (E. S. Williams pers. comm.). Black-footed ferrets which died in 1972 were killed by inoculation with a modified live virus canine distemper vaccine (Carpenter et al. 1976). Since that time, modified live vaccines have been improved and other vaccines developed. Surrogate responses to tests have been shown to be inadequate: Siberian polecats survived the modified live vaccine in 1972. Further testing will require experimental black-footed ferrets. Testing of vaccines on surplus black-footed ferrets concurrent with or prior to initial releases should be considered, so that distemper outbreaks do not confound analysis of the release program.

11511. Investigate new modified live vaccine

Inoculation with modified live vaccines may provide the greatest protection if black-footed ferrets prove able to tolerate them.

11512. Investigate bioengineered vaccine

A vaccine specifically designed for black-footed ferrets may have to be developed, depending on other vaccine test results.

1152. Document and study other diseases of black-footed ferret as they occur.

Document predisposition, symptoms, methods of treatment, and results of treatment.

12. Breed black-footed ferrets using strategies that preserve at least 80 percent of the original genetic diversity of founding animals for 200 years.

The Meeteetse black-footed ferrets have limited heterozygosity (Kilpatrick et al. 1986, O'Brien et al. in press). However, absence of electrophoretically detectable protein variations does not necessarily imply total absence of genetic variation for adaptively important characteristics which should be considered in captive management (Ballou in press). The objective of preserving remaining variability is therefore an essential part of recovery management. Although **80-percent** retention of genetic diversity falls below currently recommended levels (Soule et al. 1986), the black-footed ferret will be managed solely in captivity for only a fraction of the 200 years; free-ranging populations will constitute a much larger metapopulation for preservation of genetic diversity. Retention of 90 percent of genetic diversity is expected if wild populations reach 1,500 adults.

121. Maximize reproductive output to a population of 200 breeding adults early in the breeding program.

The faster a population with few founders is allowed to expand, the greater the retention of genetic diversity and the less likely the population is to be influenced by adverse random demographic events (Carson 1983). Decision analysis is needed to develop a reintroduction protocol that ensures that the greatest founder allele representation is used to restock wild habitats.

1211. Capture additional animals found at Meeteetse.

If additional black-footed ferrets **are located** in the Meeteetse area, they should be captured according to recommendations presented by the Wyoming Game and Fish Department (1987a). This will provide a greater representation of original allelic diversity in future generations. Established quarantine protocols should be followed (see Task 112).

1212. Ensure all individuals are involved in contributing genetic material.

The greater the initial founder representation in the F1 generation, the greater the percentage of genetic diversity that will be preserved in later generations.

1213. Use artificial means to capture the genetic contribution of individuals who will not reproduce by natural means.

With artificial techniques, more founders may participate in the breeding schedule. This will ensure that techniques will be available should problems which preclude natural reproduction arise in captivity later in the program.

12131. Improve electroejaculation techniques.

Electroejaculation is currently under evaluation (R. Atherton, Department of Zoology, University of Wyoming). Current problems include urine in the ejaculate and ejaculate quality (Kitchin and Atherton 1987).

12132. Perfect artificial insemination techniques.

Laparoscopic techniques on domestic ferrets have been developed (D. Wildt, National Zoo, Washington, D.C.) to surgically inseminate females. Other areas to be pursued include vaginal artificial insemination.

12133. Develop embryo transfer techniques.

The possibility of recovering ova and fertilizing in vitro should be explored for cases where ferrets are terminally ill.

1214. Improve breeding strategies.

Breeding protocols have been recommended by Don Carlos and Doherty (1987) and Thorne and Kwaitkowski (1987). Breeding protocols should be updated as necessary and include the schedule of pairings, method of pairing, duration of pairing, and criteria for artificial insemination. Recommended research (Wyoming Game and Fish Department 1987a) to obtain information for improving breeding success should be supported.

12141. Characterize female estrus.

Characterization of female estrus by vulvar swelling and vaginal cytology (Hillman and Carpenter 1983) is being studied by E. S. Williams (Department of Veterinary Science, University of Wyoming) and D. Kwaitkowski and T. Thorne (Wyoming Department). Significant advances have been made, and these studies

should be continued. Characterization of behavior during estrus is also under study (B. Miller, Department of Zoology, University of Wyoming).

12142. Characterize male spermatogenesis. Factors influencing male spermatogenesis, seasonal maturation, and external characteristics (testes size) need further study. Lack of viable sperm during the breeding season prevented one artificial insemination attempt in 1987 (Wyoming Game and Fish Department 1987c). Male reproduction is currently under study (R. Atherton and R. **Kitchin**, Department of Zoology, University of Wyoming; **D. Wildt**, National Zoo, Washington, D. C.).

12143. Study ways to induce reoroductioq.

Induction of estrus in anestrus female domestic ferrets has been studied (R. Mead, Department of Biological Science, University of Idaho). Other reproductive physiology is under study (B. Miller, Department of Zoology, University of Wyoming).

12144. Investiaate methods to determine oreanancy.

Ultrasound and other methods should be explored.

12145. Investigate ways to terminate pseudopregnancy.

Once bred, ferrets may enter pseudopregnancy without producing young (Mead in press). Hormones (such as PGF for livestock) could shorten the time to the next ovulation and allow females a second chance to become pregnant.

1215. Incoroorate wild black-footed ferrets from geographic greas other than Meeteetse into the breedina program (see Task 345).

As proposed in the Wyoming Department's Strategic Plan (Wyoming Game and Fish Department **1987a**), new animals found outside the Heeteetse area should be karyotyped (G and C Banding) and compared to those at Meeteetse for possible genetic divergence. It is likely that genetic differences between the new populations and those from Meeteetse would be due to drift from small population size rather than to selection (**Ballou** in press). At least one male and one female and up to nine individuals

should be moved into captive breeding facilities to provide critically important genetic and demographic contributions. Transfers to captivity and quarantine should follow established protocols (see Task 112).

122. Maximize retention of founder alleles in F1 and subsequent generations.

If some founders leave only a few offspring while some leave many, the genetic contributions of the poorly represented founders could be lost, resulting in less overall diversity (Ralls and Ballou 1986; see also Task 1212). This absolutely requires adherence to a breeding protocol in which the identity of both parents is known. If multiple sires are used, then DNA fingerprinting of all young will have to be done to establish paternity.

1221. Minimize genetic relatedness among mates.

Some relatedness of wild-captured ferrets is known, and other relatedness can be presumed. All relatedness for pairings of F1 offspring will be known if procedures under Task 1232 are followed.

1222. Make every effort to ensure that at least seven offspring from each founder pair reproduce in subsequent generations.

If founders are inadequately represented in future generations, or are represented only through one sex, then their contribution could be substantially reduced or lost. Seven F1 offspring from each pair will ensure a mathematically sufficient founder representation in the F1 generation (Ballou pers. comm.).

1223. Utilize the genetic contribution of the original 18 wild-caught ferrets as long as possible.

The greater the number of offspring produced by each founder, the greater the percentage of each founder's allelic representation in subsequent generations. Extending the reproductive span of each founder through the first few years when the population is expanding not only increases representation but also extends the mean generation time, which in turn delays the loss of heterozygosity through time by reducing the total number of generations produced.

12231. Develop techniques for cryopreservation of black-footed ferret semen for use in artificial insemination of future generations.

Development of cryopreservation of semen is underway (B. Atherton, Department of Zoology, University of Wyoming; D. Wildt, National Zoo, Washington, D.C.). Initial results are positive, but thawed sperm has yet to be used to fertilize female black-footed ferrets.

12232. Research cryopreservation and in vitro fertilization of ferret ova.

Techniques have not been developed.

1224. Ensure effective migration of the genetic material between facilities to maintain heterozygosity.

Genetic drift (gene frequencies which change through generations from unequal "sampling" of genetic loci) is a problem in populations smaller than the genetically viable size (Franklin 1980). Avery (1978) suggests migration of one/individual per generation into small populations is sufficient to counter the effects of drift.

123. Evaluate fitness, genetics, and demography of the captive populations.

Measurement of how well objectives are being reached is necessary to evaluate progress and make adjustments in program strategy.

1231. Evaluate genetic diversity at the nucleic acid level and its potential contribution for monitoring the breeding program.

Because current electrophoresis only identifies 1 polymorphic locus out of 46 tested (O'Brien et al. in press), it will not be useful in measuring changes in heterozygosity in the breeding program. Nucleic acid monitoring may be useful and is currently being developed (S.J. O'Brien, National Cancer Institute, Frederick, Maryland).

1232. Keep records on all individuals.

Precise record keeping is essential. Genetic management intended for this species depends exclusively on mating of known individuals and their

history. Inbreeding rates may be an order of magnitude higher where random mating is used in preference to a deliberate plan (Seal 1978). Future management of ferrets in the wild also may require individual records for management purposes.

12321. Identify individuals through permanent marks.

Despite housing protocols and **handling** care, it is not unlikely that animals may be inadvertently mixed and confused during transfer. Because the entire program of genetic management hinges on known individuals, it is essential that all animals be marked to avoid any possibility of confusion. Marking **black-footed** ferrets is somewhat problematic (Fagerstone et al. 1985); electric tattoo pens and transponders may afford alternative marking methods for captive **stock** (see Task 41432).

12322. Maintain permanent records.

A studbook should be kept using American Association of Zoological Parks and Aquariums and International Zoo Yearbook procedures.

12323. Adopt a duplicate record-keeping system.

Participation in International Species Inventory System (ISIS) is currently required for American Association of Zoological Parks and Aquariums approval of a Species Survival Plan. Use of this system or another computer-based system is essential and should be required for participation in the breeding program.

12324. Curate the collection of carcasses at each facility and centralize specimen records.

Future analysis of skeletal and other materials may prove useful. The deposition of carcasses should be noted by the **studbook** keeper and the data centralized to facilitate future study.

12325. collect and adequately store tissue samples from all dead ferrets.

Tissues (brain, liver, kidney, spleen, muscle) storage may require specialized handling (e.g., **-70° C** freezing) to be useful for future analysis. Protocols should be followed.

1233. Develop a program to evaluate individual characters.

Records should be maintained on phenotypic characteristics. A program to cull "deleterious" traits is not **recommended** at this time, because important but **unknown** traits and diversity could be inadvertently **lost**.

13. Provide facilities for black-footed ferret reproduction and survival.

Captive facilities for black-footed ferrets will be located in at least three geographic locations. Consistent environmental conditions to ensure survival of black-footed ferrets during captivity and provide optimum conditions for reproduction from facility to facility are necessary. Husbandry strategies may differ for animals destined to remain in captivity than for those which are scheduled for release.

131. Develop dietary protocol.

Diet may be extremely important to black-footed ferrets' health and could influence ferret reproduction (Richardson et al. 1986, Diernfeld 1987).

1311. Understand nutritional and behavioral contributions of natural prey (prairie dogs) to captive black-footed ferret diet.

Dietary regimes for animals that are to be released may differ from breeders. For example, wild-caught **black-footed** ferrets seem to prefer **Prairie dogs** to **commercial** diets (E.T. Thorne pers. **comm.**). It may be important to entrain black-footed ferrets on prairie dogs prior to release so they recognize them as food, although regimes of diet maintenance for behavioral purposes are **NOT** fully understood. Also, although crude protein percentages are known for prairie dogs in the fall (Powell et al. **1985**), seasonal variation in fat could affect fat-soluble vitamin concentrations (A and E), which could influence black-footed ferret nutrition if prairie dogs caught in the fall and stored frozen are fed year round (Diernfeld 1987). Studies have been proposed to investigate this (E. Diernfeld, Bronx Zoo, New York).

1312. Study the contribution of diet to black-footed ferret reproduction.

Nutritional aspects of black-footed ferrets' diets at various times of the year and their contribution to reproduction need to be fully explored (Diernfeld 1987).

132. Develop liachtina protocol.

Photoperiodicity will affect reproductive success of animals in captivity (Herbert in press). It also may be possible to extend the reproductive period in ferrets through photoperiod manipulation.

133. Develop husbandry protocol.

Each facility will have its own infrastructure for ferret maintenance. However, standardized management specifically for black-footed ferrets is **recommended**. Core management protocols must be developed and used.

1331. Provide optimum breeding environment.

A definition of optimum breeding environment should be developed through experimentation by assessing reproductive output, copulation success, or other variables relative to various breeding environments.

1332. Provide optimum whelping environment.

A whelping management protocol is in place at Sybille (Wyoming Game and Fish Department 1987a).

1333. Provide optimum rearing environment.

Problems in black-footed ferret rearing will only become known with time. Options chosen for rearing must be carefully documented for later analysis should problems arise later in the breeding program. Nutrition of juveniles and mothers, development of juvenile social behavior, time of independence from mother, or other variables that can be controlled and tested should be recorded. Weight (body mass) data on juveniles will also be useful in managing future developmental performance.

14. Maintain populations of surroaates to assist in rearina vouna and for exoerimentation where reproductive black-Footed ferrets cannot be risked.

Closely related species (M. eversmanni and M. putoriug) may be useful in rearing young black-footed ferrets which cannot be raised by their natural mothers and for experimentation on techniques which might expose reproductive black-footed ferrets to undue risks.

141. Establish population objectives and management criteria for surrogates.

Surrogates will be of primary use early in captive breeding until surplus black-footed ferrets (not part of the reproduction program) are produced. Analog surrogates should then be discontinued. Population size objectives for surrogates should be developed. Other husbandry requirements discussed in Task 13 are applicable.

142. Establish policies for use of nonreproductive black-footed ferrets.

At this time, all founder and **F1** progeny are of extreme value in preserving genetic representation and should not be considered expendable. Nonreproductive black-footed ferrets (F2 generation or later) could be used in public education programs (see Task 6221) or for research related to **black-footed ferret** preservation (see Task 1151). A definition of black-footed ferrets which are nonessential for reproduction needs to be written, as do ethical guidelines for their use.

2. Locate, evaluate, and maintain potential black-footed ferret habitat (prairie dogs) in North America.

Public and private lands in the United States may currently harbor between 2.0-4.0 **million** ac (0.8-1.6 million ha) of prairie dogs (F.R. Henderson pers. **comm.**). A large percentage of this area is probably inappropriate for black-footed ferret habitat because of the small size of individual areas, distance to adjacent prairie dogs, or proximity to conflicting land uses.

21. Define potential black-footed ferret habitat for recovery by 1988.

Biological habitat criteria for black-footed ferrets have been suggested (**Hillman** et al. 1979, Forrest et al. 1985a) but could differ from reintroduction site criteria depending on the amount of area needed for buffers, management intensity anticipated, and variation assumed for habitat variables. Basic agreement on what constitutes a prairie dog complex (distance between colonies, colonies separated by geographic barriers) must be reached. Modeling existing known **parameters may** assist in this process. Simulation models which describe extinction probabilities from plague and canine distemper may be useful in developing recovery site rankings. **Cost** estimates of various scenarios could be decisive in pointing to the most feasible recovery solution among a number of potential reintroduction site size distributions. Decision analysis (Maguire in press) could be an important tool in choosing between apparently similar options. Future **recommendations** can be adjusted once the results of reintroductions are known.

22. Determine the distribution of prairie dogs defined as black-footed ferret recovery habitat in Task 21 by 1989.

Because of the timetables for other recovery activities, black-footed ferret habitat must be identified as soon as possible. Lead times for captive reproduction cannot be formulated precisely, and, therefore, production of ferret young must proceed with the expectation that management programs will have been prepared by the time ferrets are ready for release. If habitats are not available, facilities might have to cut back on production, which would have unforeseeable consequences for the integrity of the captive breeding program.

221. Map prairie dog colony complexes in each State.

Strategies should be developed for identifying prairie dog complexes in each State. A strategy employed in Montana (Clark et al. 1987) could provide a basis for comparing data relevant to black-footed ferret habitat. Overall coordination of this effort should be facilitated by the Black-footed Ferret Interstate Coordinating Committee.

2211. Agree on standardized data collection.

Data collected for candidate reintroduction sites must be comparable so that sites can be ranked on a regional basis. A system for collecting data must be agreed upon by the Interstate Coordinating Committee and updated when new data are available.

2212. Assign major responsibility and compile data.

Data collection can be facilitated through a State working group. One individual must be identified to act as mapping coordinator for each State or geopolitical area, or the Interstate Coordinating Committee may wish to identify other individuals or coordinate with the Service if interest at the State level is lacking. It will be that individual's responsibility to collect data and report results to the Interstate Coordinating Committee by 1989.

22121. Use existing data.

Existing data may be available through environmental or health agencies, private consultants, public and private land management agencies, and State wildlife agencies.

22122. Conduct field surveys.

Inventories of prairie dogs may be made using ground or aerial surveys. Analysis of recent U.S. Soil Conservation Service photography may be adequate in many cases (Cheathead 1977, Bishop and Culbertsen 1976). When recent Soil Conservation Service coverage is lacking or of poor quality, custom photography (Tietjen et al. 1978, Dalstead et al. 1981) or additional flying and ground truthing efforts may be required.

222. Identify prairie dogs in Canada and Mexico.

Additional sites to meet recovery objectives for this species over and above national objectives may be available in Canada and Mexico. Additional habitat that may be available outside the United States should be evaluated and programs established to cooperate in international recovery of the species.

2221. Identify cooperators in Mexico.

Black-tailed prairie dog complex sizes in excess of 50,000 ac (20,000 ha) have been identified in Mexico (G. Ceballos, National University of Mexico). Contacts at the international level through conservation organizations and the Service or Agency for International Development need to be established.

2222. Identify cooperators in Canada.

Prairie dog distributions are restricted to southern Saskatchewan. Preliminary work on assessing ferret habitats has been initiated (Laing 1986). Contact should be established with the Canadian Endangered Species Office, Canadian Wildlife Service.

2223. Seek funding under Section 8 of the Endangered Species Act if sites in Mexico or Canada are found that could assist in species survival.

The Act calls for international cooperation for listed species and provides for assistance to other countries.

23. Develop a plan for ranking reintroduction sites and rank the top 20 candidate sites by 1989.

Two habitat evaluation models are presently available (Houston et al. 1986, Miller et al. in press) which could provide a basis for ranking reintroduction sites. Besides biological criteria, sociological factors such as local human support of wildlife, degree of legal

protection provided the habitat, ease of administration, proximity to research facilities, potential for expansion, and potential to provide educational benefits to the public are other considerations to be agreed upon. A priority system should be developed by the Black-footed Ferret Interstate Coordinating **Committee** in consultation with research and modeling specialists.

24. **Develop and implement monitoring and management prescriptions for the top 20 sites.**

By developing prescriptions for the top **20** sites, alternate sites will be prepared well in advance of reintroduction should problems arise with one or more of the primary sites.

241. **Develop and implement management plans for prairie dog colonies.**

Prairie dogs must be managed at levels appropriate to support long-term sources **of renewable** food and shelter for **black-footed** ferrets, although maintenance of black-footed ferret populations may be only one of several objectives in a prairie dog management plan. Such plans may be developed by a consortium of agencies and may be Statewide in scope (Montana Department of Fish, Wildlife and Parks in preparation). Alternatively, more specific plans may be appropriate where an abundance of habitat occurs in a small area or is under the jurisdiction of a single agency (U.S. Bureau **of** Land Management 1982, 1986).

2411. **Identify all prairie dog colonies to be included in the complex.**

Identification will have been done in conjunction with Task 221.

2412. **Identify potential for prairie dog colony expansion.**

This can be accomplished by looking at the historical use of the area by prairie dogs, from documentation of control histories, or by developing a profile of habitat suitability criteria that would give probabilities of the potential for expansion.

2413. **Set target levels for the sites of prairie dog colony complexes to be maintained.**

Target levels will be based on estimated carrying capacity, estimated harvest rates of prairie dogs by black-footed ferrets and other predators, contributions of area necessary to meet minimum black-footed ferret requirements and large enough to complete total metapopulation objectives, and the need for expansion.

2414. Determine the Potential impacts of plague and other disturbances to prairie dogs.

Adverse effects on prairie dogs within one population could have far-reaching cumulative effects on black-footed ferret recovery if variability cannot be planned. Disruption of the ferret prey base by catastrophic plague epizootics can be managed if **probabilities of outbreak occurrence** can be determined.

24141. Determine patterns and occurrences of plague in the immediate geographic area of reintroductions.

Surveys for **plague may** require serologic sampling of small **mammals**, flea sampling, and testing of tissues from dead prairie dogs.

Review existing data from Centers for Disease Control, State public health agencies, Animal and Plant Health Inspection Service, and others to determine preferred surveillance techniques.

24142. Research plague impacts.

Predictive models given various environmental scenarios should be developed. Research to address specific questions should be formulated.

241421. Determine distribution of flea vectors during disease outbreak and in enzootic conditions.

This will help to develop an understanding of the presence of plague and possible factors leading to its occurrence.

241422. Assess the effects of plague on prairie dog population dynamics.

An assessment of plague should include both short- and long-term studies to assess ecological susceptibility to outbreaks, which age classes tend to persist, and modes of transmission. Consider controlled experiments of introduced plague.

2415. Plan and schedule manipulations of prairie dog populations.

Advance planning will ensure that all management entities are in agreement prior to manipulations and will help identify preliminary activities (such as clearances or documentation) that must be completed before activities begin.

24151. Determine livestock use levels.

This will depend on range condition. Livestock grazing is considered compatible with black-footed ferret management objectives. Levels of grazing should be set to stabilize levels at predetermined densities.

24152. Identify techniques for increasing prairie dog populations.

In some locations, prairie dog populations may be enhanced to improve existing habitat. Efforts by the Utah Division of Wildlife Resources to recover Utah prairie dogs should be investigated. Methods to expand prairie dogs are discussed by Collier (1975), Elmore and Workman (1976), Lewis et al. (1979), and Player and Urness (1982).

24153. Identify techniques for control of prairie dog populations.

As part of management agreements, prairie dogs outside of the boundaries of designated recovery areas may have to be controlled on adjacent lands where they are not tolerated. Animal Damage Control (Animal and Plant Health Inspection Service) can be contacted regarding licensing and registration of materials.

241531. Determine secondary effects of toxicants on black-footed ferrets.

Toxicants found to have secondary effects on black-footed ferrets include 1080 (Hillman 1968). Zinc phosphide was found to have an emetic effect on Siberian polecats, which afforded them a degree of protection from secondary effects (Hill and Carpenter 1982). Other research related to the risk of

poisoning from feeding behavior is under study (S. Joyce, Department of Zoology, University of Wyoming; G. Matschke, Denver Wildlife Research Center).

241532. Test nontoxic control methods.

Methods for nontoxic control, such as deferred grazing (Knowles 1982) or sport hunting (U.S. Bureau of Land Management 1982), should be investigated for their application where toxicants are inappropriate.

2416. Establish cooperative management agreements with public and private landowners.

Black-footed ferret reintroduction will not prove successful without cooperation of land managers. Management agreements should stipulate responsibilities of all parties for long-term commitments to black-footed ferret management.

242. Collect information on reintroduction sites for screening and baseline data purposes.

Unexpected changes occurring as a result of reintroductions can be detected by monitoring baseline conditions (Orians et al. 1986). Changes in vertebrate or invertebrate populations in habitats where ferrets are released may give clues to important processes that are affecting an ongoing reintroduction, allowing timely program changes if necessary. Intensive monitoring should not be discouraged but will probably be unnecessary if monitoring results from experimental reintroductions (see Task 423) are negligible or inconclusive. Screening procedures should be conducted at least 1 year, and preferably 2 years, prior to release and continue on a regular basis (Clark 1986). Results of postrelease changes in predators, prairie dogs, or habitat should be evident 2 years following initial releases (see Task 423).

2421. Conduct black-footed ferret surveys.

A clearance survey to ensure no black-footed ferrets are present within the proposed reintroduction area must be conducted prior to release.

2422. Collect flea samples for plague.

The presence and distribution of plague within the complex should be determined using current sampling procedures. Plague-positive samples should indicate additional work to assess the temporal and spatial distribution of the flea vector. Authorities on plague studies should be consulted to determine preferred sampling techniques.

2423. Document predator/competitor occurrence.

Predators have been shown to be important causes of black-footed ferret mortality (Forrest et al. in press) (also see Task 4132).

2424. Measure prairie dog population characteristics.

The most important attributes will be those useful in modeling (see Task 5113); these include sex and age ratios, estimates of natality and mortality to construct intrinsic rates of increase, and stability through time (number/ac or ha).

2425. Sample for the presence of canine distemper.

A widespread carnivore assay (Williams 1987) is probably not adequate, and a survey more than 1 year in duration may be required. Authorities on canine distemper should be consulted for preferred surveillance methods.

243. Evaluate legal and procedural obligations at the State and Federal levels.

Compliance with State and Federal statutes may be necessary before certain recovery activities can proceed, particularly regarding land use. Lead times for publishing and developing findings could delay timely recovery.

2431. Determine obligations under NEPA.

Determine whether it will be necessary to prepare an Environmental Assessment or Environmental Impact Statement before reintroduction occurs.

2432. Explore consequences of black-footed ferret designation as an "experimental population" under Section 10 of the Act.

The Act allows limited "taking" of listed species under certain conditions. Black-footed ferrets which stray

from designated habitats may fall into this category if management agreements to that effect are established prior to reintroduction. A finding by the Service for black-footed ferrets should be articulated and made available for developing reintroduction options.

2433. Recommend to the Service a description of "core management areas" essential for black-footed ferret recovery.

The Black-footed Ferret Interstate Coordinating Committee or other interested party may recommend to the Secretary of the Interior a description of those habitats critical to survival of the black-footed ferret, which may be one or more of the selected reintroduction sites (see Task 23). The designation would allow regulation of activities which could adversely modify that habitat.

2434. Investigate obligations under Section 7 for habitat identified as a recovery area.

Determine whether designations of recovery areas will require Section 7 consultation.

2435. Investigate the development of policies for prairie dog management outside areas identified as potential or essential recovery areas for black-footed ferrets.

As an incentive to encourage designation of recovery areas (Tasks 22, 23, and 24), States should be allowed greater management flexibility for habitats designated as nonessential for black-footed ferret recovery. Options to provide this flexibility should be investigated.

244. Provide protection for candidate sites.

Protection is generally concerned with legal aspects but also includes developing working relationships among agencies and with the public.

2441. Encourage changes in State statutes to prevent mandatory destruction of prairie dog colonies.

Some State laws require extermination of prairie dogs. Under these circumstances, conflicts with the Act as it applies to black-footed ferrets appear unresolved. Legislation to clarify the status of habitat intended for reintroduction of black-footed ferrets will be necessary. The participation of Federal agencies in poisoning efforts should be reviewed.

2442. Acquire habitat.

Habitat acquisition ensures legal control over management activities. State or Federal governments should seek assistance from nonprofit conservation organizations qualified under Sections 501 and 170 of the Internal Revenue Code to accept donations of land for conservation purposes. Organizations such as the Nature Conservancy should be solicited for participation in the program. Condemnation of land will not be considered.

24421. Obtain title.

Use of Service contingency funds or Fish and Wildlife Foundation funds may be available for emergency purchase. Also consider exchanges of Federal lands, gifts through estates, and purchase through nonprofit organizations.

24422. Obtain easements.

Easements could be purchased outright, granted through tax deferment, or obtained without fee, but should be granted in perpetuity.

2443. Model cumulative effects of prairie dog control on black-footed ferrets by State.

States should comprehend what impact individual control activities have on black-footed ferret management objectives. Modeling cumulative effects will allow a State to set initial targets for prairie dog management by identifying black-footed ferrets as one key component of the prairie dog ecosystem.

245. Initiate an information and education program for reintroduction sites.

A well-designed and executed public education program will encourage public participation in efforts to restore the black-footed ferret. Public education will require constituencies at the community level, as well as the State and regional levels (see Task 62). Coordinated information dissemination among the Service, States, other Federal agencies, and private organizations will be required. Efforts of the information campaign should be directed to preserving prairie dogs (see Task 2441).

2451. Promote an understanding among land managers of the role of prairie dogs in prairie ecosystems.

Prairie dogs are generally regarded unfavorably by land managers. Many misconceptions regarding the role of prairie dogs and their impact could be explained through effective dissemination of existing data.

2452. Consider developing regional sociological profiles to support black-footed ferret reintroduction.

Studies such as those by Kellert (1985) for Minnesota wolves may be useful in detailing the values held by local citizens and in developing support for protection programs.

2453. Hold public meetings to discuss black-footed ferret reintroduction.

Discussions with livestock groups, local weed and pest boards, State and Federal animal damage agencies, citizens, and community leaders should be conducted to identify and address concerns of those individuals.

2454. Seek support from conservation and wildlife organizations.

State and national conservation organizations should be asked to participate wherever possible, from assisting in locating reintroduction sites to developing and coordinating public information strategies.

246. Implement management plans and prescriptions and begin the monitoring program for the first three sites by 1989.

Start implementation of Tasks 241-245.

3. Locate additional populations of black-footed ferrets.

Because the probability of finding new ferret populations declines with time, and because the outcomes of captive propagation and reintroduction may change, the value of ferret searches as opposed to other avenues of recovery should be reevaluated annually. In the meantime, locating additional populations will contribute to the recovery objective by contributing individual numbers and potentially unique genetic material to the Meeteetse founder stock (see Task 1215).

31. Actively search for black-footed ferrets.

Active searches require the existence of a permanent search team.

311. Adopt a system for evaluating and prioritizing all new reports.

Several systems for ranking sightings are currently in place (Hammer 1985, Cada 1985, U.S. Fish and Wildlife Service 1986).

312. Search for black-footed ferrets on a priority basis.

Black-footed ferret searches should be directed to locations with the highest probability of success of locating additional ferrets.

3121. Use an historical data base to identify potential habitat w searches have not been conducted.

Ranking from an historical data base can be done in conjunction with Task 221.

3122. Respond to reports as they arrive.

Identify a pool of trained individuals who can respond to priority sightings in a timely manner. Timeframes for responses should depend on priority criteria.

313. Conduct training workshops on updated search techniques for individuals and organizations.

Training workshops are made available annually through the Cooperative Fish and Wildlife Research Unit, University of Wyoming, Laramie.

32. Solicit new black-footed ferret reports from the public.

Public awareness plays an important role in black-footed ferret surveys. Solicitations of black-footed ferret reports have been the most effective means of obtaining information on the species (Henderson et al. 1969).

321. Offer a reward for information leading to the discovery of new ferret populations.

A reward system, sponsored by the New York Zoological Society, was instituted in Montana in 1986. No black-footed ferrets have been located as a result of the reward. A regionwide reward system should be considered.

322. Continue public information and education.

Stress the importance of new populations to the continued existence of the species, and bring the identity of the species

to the public eye. Incidental information about the species' history, distribution, or biology that the public can provide may be useful.

33. Improve search efforts.

More effective search techniques and greater application of those techniques may help in locating existing black-footed ferret populations, particularly those which may occur at low densities or are highly dispersed.

331. Ensure the use of current Service search guidelines or their equivalent.

Search guidelines were developed to "clear" prairie dog colonies prior to control projects and other activities which could adversely affect black-footed ferrets. Guidelines were designed to maximize the probability for locating black-footed ferrets within the most reasonable period of time (Appendix I). Searches should be mandatory and enforced until completion of Tasks 22, 23, and 24 in each State.

3311. During the Section 7 consultation process for Federal actions, recommend ferret searches for those activities impacting black-footed ferret habitat (prairie dog colonies).

Section 7 consultation is handled by the Service's Fish and Wildlife Enhancement Office, which evaluates the potential impact of all Federal actions on the black-footed ferret.

3312. Ensure enforcement of Environmental Protection Agency label restrictions on rodenticide application prior to prairie dog control.

Strychnine label restrictions require that black-footed ferret searches be conducted before strychnine is applied (Environmental Protection Agency 1987). The label restriction should be enforced by a designated agency and compliance reviewed annually by the Service and participating States.

3313. For private or State authorized activities, recommend black-footed ferret searches prior to activities that may impact ferret habitat.

States and private land managers need to be aware of the importance of: control activities on national recovery goals for the black-footed ferret, locating additional ferrets, and species preservation.

332. Develop and improve survey techniques.

Existing techniques work, but in many cases cannot be implemented in large-scale survey efforts because they are too manpower intensive or expensive. Techniques that are easier to employ, yet effective, should continue to be researched.

3321. Explore potential for chemical attractants from captive ferrets.

It is unknown whether black-footed ferrets will respond to lures developed from their own scents. In the past, artificial lures or scents from other animals have been tried without success.

3322. Establish feasibility of gas chromatography, High Performance Liquid Chromatography (HPLC), and mass spectrophotometric methods for scat analysis.

Feasibility of identifying scats through gas chromatography is currently under study (M. Johnson, Louisiana State University, Baton Rouge).

3323. Improve aerial surveys by simulation/testing.

Procedures have been developed for detection of black-footed ferret signs on snow (Biggins and Engeman 1986), but detectability calibration is needed.

3324. Model predictability of spotlight detection under varying conditions.

Tests using "artificial" black-footed ferret reflectants under trial conditions could be used to develop a "detectability function" for future spotlight surveys.

3325. Improve understanding of digging behavior by prairie dog hole plugging.

Black-footed ferret diggings (Clark et al. 1984b) may be related to prairie dog hole plugging. The frequency of hole plugging by each species of prairie dog in different geographic locations may provide some indication of whether to expect black-footed ferret diggings to occur.

3326. Test use of dogs using scent combinations from captive ferrets and field trials.

The dog program was discontinued in 1980 and, therefore, was not tested on black-footed ferrets in the field.

34. Implement contingency plans if black-footed ferrets are located.

Contingency plans such as those proposed by Cada (1985) and Wyoming Game and Fish Department (1987a) need to be implemented as soon as possible after black-footed ferrets are located to avoid public controversy and loss of ferrets. Contingency plans should be developed for all States where ferrets could be located.

341. Develop contingency plans for all States where black-footed ferrets could be located.

Unnecessary delays can be avoided if plans are in place before black-footed ferrets are found. Plans should be endorsed or reviewed by the Black-footed Ferret Interstate Coordinating Committee (see Task 1215).

342. Obtain the necessary State and Federal agreements and scientific permits to implement Tasks 343-346.

All such agreements and permits must be kept current.

343. When ferrets are located, capture at least two (one male, one female), and, after an inventory of the population, capture an additional seven.

Following discovery of a new population, action should be taken immediately to capture two individuals and to assess the population's viability. The addition of just two ferrets would greatly increase the demographic stability of the existing captive population and contribute to increased genetic diversity. The capture of 9 ferrets would increase the captive population to the desired level of 20 founders. Capture of additional animals should follow special considerations requiring release of lactating females and preferential capture of young from different litters. Guidelines for intervention and immediate removal of all or a portion of the animals must be in place.

344. Capture, handling, and shipment to captive breeding facilities and quarantine of captured ferrets should follow accepted protocol.

Cooperating States should contact Dr. E. T. Thorne, Wyoming Game and Fish Department, to obtain recommended procedures.

345. Inventory the newly located ferret population and cooperatively develop additional capture rates within 1 year following the location of the new population.

Considerations for the development of additional capture rates should include: risk of driving the remaining population to

extinction and potential for population maintenance; the need to obtain 20 founders from newly located genetic stock; and the value of a remnant population to enhance reintroduction efforts (at both the new site and at additional sites).

346. Develop management plans.

Site-specific management plans should be developed within 1 year of discovery of a new ferret population.

4. Begin continuous releases of black-footed ferrets into reintroduction sites when captive populations have reached or approach a sustainable census size of 200.

The current captive population projections indicate effective captive population size of 250 by 1991 (Ballou and Oakleaf 1987). Thereafter, at least 50-150 black-footed ferret young should be available for release annually. This number could be substantially higher. The actual number available for annual release will depend on the following:

1. Demographic performance and management of the captive population;
2. The age and sex ratios of animals used for releases; and
3. Whether released ferrets include pregnant females.

Whether all are released in the same year, or held for further training or for releases at higher numbers, will be determined by the release strategies that are developed. Simultaneous releases employing slightly different methods should be attempted if release stock is available. Consideration also should be given to controlling confounding factors in the analysis of the release, such as canine distemper (see Task 1151) or other variables.

41. Design release procedures.

The design of the entire release strategy should be developed in conjunction with leading experts worldwide, focusing specifically on small carnivores. At present, few studies of release planning have been articulated. A need for additional literature review and theory development beyond the scope presented in this plan is necessary.

411. Prepare a reintroduction schedule.

Captive production could potentially be constrained if release sites are not ready to be used when stock becomes available (see Task 22). If all of the 20 sites selected in Task 23 appear necessary for recovery, a new reintroduction will have to be started every 1.5 years to meet the objective. Several reintroductions could be "clustered" at 2- or 3-year intervals to take advantage of personnel, build up sufficient stock, and

allow time to evaluate previous reintroductions. The Black-footed Ferret Interstate Coordinating Committee should coordinate release scheduling. Decision analysis could be useful in identifying the most efficient scheduling approach.

4111. Prepare priority sites for reintroduction.

Execute items listed under Task 24.

4112. Schedule black-footed ferret stock for release.

To be most efficient, stock production and releases must be scheduled in advance, including any shipments between facilities for training.

41121. Develop an age and sex structure for release.

Demographic and genetic modeling to identify the population level at which surplus production will be available for release must be completed. A number of considerations are pertinent. For example, decisions on whether pregnant females should be considered for release, whether siblings will be released together, and the appropriate sex ratio for release are needed.

41122. Determine time of year for release.

Release timing will depend on developmental stage desired for release stock.

4113. Establish criteria for abandoning sites if releases fail after repeated attempts.

Repeated failures at some sites may indicate the site is unsuitable. This can only be evaluated after reintroduction succeeds elsewhere. Criteria should be in place to suggest a change in site emphasis if necessary.

412. Develop conditioning techniques for captive populations and assess the need for conditioning prior to release.

Some animals raised in captivity lack skills for living in the wild (Campbell 1980). Release programs should consider a period of training and conditioning to accustom animals which have been raised in captivity to the wild environment.

4121. Experiment with development of training skills.

Training may have positive effects on black-footed ferret survival following release. The types of training can be evaluated in the laboratory by assessing the response of animals to training.

41211. Design and build training arenas.

The Wyoming Department is constructing small, enclosed prairie dog colonies for black-footed ferret training in 1988 as part of the Sybille Wildlife Research and Conservation Education facility (E.T. Thorne pers. comm.).

41212. Test methods to familiarize black-footed ferrets with prey and killing.

As discussed under Task 1311, recognition of potential food items, black-footed ferrets will have to learn hunting behaviors. At least some of this may be learned in the wild (Eibl-Eibesfeldt 1957, 1961, Heidt et al. 1968, Clark et al. 1986b). At least a portion of juvenile mortality in the wild can probably be attributed to a lack of foraging skills. Other evidence suggests that the killing behavior of mustelids may be innate (Powell 1982, Wustehube 1960, Gossow 1970).

41213. Test methods to train black-footed ferrets to avoid predators.

Black-footed ferrets raised in captivity may lose some alertness to natural predators or lack the ability to recognize potentially dangerous situations. How much of this is learned behavior in the wild is unknown.

4122. Adopt a training strategy.

Based on the outcomes of experiments through Tasks 41212 and 41213, and on field data on survival, decide what level of training, if any, is appropriate or necessary for later releases.

413. Develop experimental designs for releases.

A study plan should be developed prior to releases to identify variables that could potentially affect the outcome of the

release and measure whether those variables did indeed have an effect on the release outcomes. Orians et al. (1986) suggests possible statistical designs for such experiments.

4131. Develop criteria for using hard versus soft release techniques.

"Hard" releases are releases of large numbers of animals directly to a site without acclimatization. "Soft" releases involve a period of semi-wild containment to acclimatize the released animals to the new environment. Soft releases have been used with reintroductions of swift fox (Scott-Brown et al. 1986) red wolves (Bass 1987), and most successful mustelid translocations (Richardson et al. 1986). However, intermediate release schemes (e.g., semi-soft) could be envisioned that would require much less investment in effort and dollars while providing comparable results. Hard releases may become feasible if surplus captive production is available.

41311. Review literature on releases.

Translocation releases for some mustelids were reviewed by Richardson et al. (1986), but review is needed on captive to wild releases. Cost estimates should be explored.

41312. Assess soft release equipment needs.

Cages, buildings, staff, and feeding protocols required for soft release need to be assessed.

4132. Determine needs for habitat modification.

Although predator/competitor reduction has seldom been attempted in other reintroductions (Richardson et al. 1986), it could increase ferret survival. Over 90 percent of known mortalities in swift fox reintroductions from captive-released animals were due to predators (Scott-Brown et al. 1986). Whooping crane releases are conducted in conjunction with predator control (Drewien et al. cited in Laing 1986). In Utah, badger control is practiced in recovery efforts for Utah prairie dogs. A one-time reduction of predators should be considered. The need for supplemental feeding immediately after release should be reviewed.

414. Develop postrelease monitoring techniques for ferrets.

At least some portion of released populations must be marked to assess population status, reintroduction and/or translocation success, and mortality and natality.

4141. Improve radiotelemetry equipment.

Improved radiotelemetry equipment is presently under study (D. Biggins, Fish and Wildlife Service, National Ecology Research Center, Fort Collins, Colorado).

4142. Improve censusing techniques.

Censusing techniques that employ sight-recapture models (Minta and Mangel unpublished) may be useful and need further development.

4143. Recommend methods of individual identification.

Evaluation of release success requires knowing the fate of individuals. Current methods of individual identification are limited.

41431. Review ear tag designs.

Monel fingerling fish tags placed in one or both ears persisted for 1 year in an estimated 60 percent of all animals tagged at Meeteetse. Greater reliability is necessary if use of ear tags is to be continued.

41432. Investigate body markings.

Tattoos made on ferrets at Meeteetse were generally not legible, but more refined tattoo instruments, such as electric tattoo pens, might enhance tattoo legibility. Freeze-branding was not attempted.

41433. Retest transponders.

Transponders did not appear to affect animals, but previous designs had high failure rates (Fagerstone and Johns 1987). New designs have been tested and had no failures for 1 year (K.A. Fagerstone pers. comm.).

42. Conduct experimental releases of black-footed ferrets into the wild as the captive population approaches a census size of 200.

Reintroduction of captive black-footed ferrets into wild habitats should not jeopardize the continued existence of the captive population. If captive reproduction is consistent and demographic projections indicate that ferrets will reach the captive population objective within two breeding seasons, some segment of the population (see Task 41121) could be designated for a small experimental

release. The projected time of the first release is 1990 or 1991 (Ballou and Oakleaf 1987). The number of ferrets that will be released will depend on availability of individuals (see Task 41121) and captive demography. Initial small-scale releases should be designed to assess release methods.

43. Evaluate reintroduction success and release techniques for the first three large-scale reintroductions.

Data collected will not only be used to evaluate reintroduction success, but will also provide further information on basic black-footed ferret ecology and black-footed ferret-prairie dog interrelationships (Bogan 1985). A review of the monitoring plan should be provided by the Service's National Ecology Research Center. States not involved directly in the reintroduction should be invited to observe and evaluate techniques for adaptation to their own reintroduction programs.

431. Census populations based on techniques developed in Task 4142.

Monthly censusing will be required on initial reintroductions. Mark/recapture, mark/reobserve (with telemetry), snow tracking, and litter censuses should be used where appropriate.

432. Investigate natality and mortality.

Natality can be estimated during the summer census or from sampling. Marking will be required to determine the percentage and age of breeding females. Mortality can be estimated from population counts or radiotelemetry.

433. Investigate emigration, immigration, and dispersal.

Identifying black-footed ferret movement will require radiotelemetry, intensive marking/recapture, or both.

434. Investigate home range and territoriality.

Radiotelemetry and snow-tracking studies will aid in defining habitat requirements.

435. Investigate interspecific interactions.

Evidence from South Dakota and Wyoming indicates that predators are important sources of black-footed ferret mortality. Predators also compete with ferrets for food. Greater understanding of these interactions could lead to more sophisticated management of reintroduced populations.

436. Evaluate changes in habitat that occur following reintroduction (see Task 2421).

Habitat changes may reveal the need for predator control, prairie dog enhancement, or other manipulations to improve reintroduction success.

44. Operationally release black-footed ferrets, incorporating ongoing evaluation, until a prebreeding census population of 1,500 is established in the wild by the year 2010.

Continue releases using the most effective and cost-effective means (based on release evaluations from Task 42) to stock remaining habitats.

441. Implement a greater reliance on translocated versus captive-reared stock for releases.

Swift fox reintroductions were more effective using translocations of wild-caught stock than captive-reared stock (Scott-Brown et al. 1986). As wild ferret populations increase, translocations from established populations should supply greater contributions to the numbers of release animals. This will require development of a definition of surplus wild stock (see Task 531) and a scaling down of the production of ferrets in captivity.

442. Institute a program to ensure founders are represented in the release populations.

If founders are underrepresented due to biases in mortality following release, replacement stock should be chosen from the same founder stock until large enough sample sizes are developed to ascertain whether the failure is adaptive or simply due to chance.

5. Manage reintroduced and other populations.

In general, the reintroduction approach should require minimal post-reintroduction management. Management should primarily be concerned with monitoring population performance, replacing previously transplanted stock that have been lost, or initiating new populations where necessary.

51. Develop strategic management for reintroduced populations.

Intervention should be minimized in reintroduced populations if: (1) genetic objectives are not threatened, (2) numerical objectives can be maintained or reestablished, or (3) survival of the species is not at stake. As the national facilitator, the Service should establish guidelines for dealing with threats to ferret populations with the assistance of the Black-footed Ferret Interstate Coordinating Committee and others.

511. Monitor black-footed ferrets.

Monitoring of ferret populations following establishment (e.g., 5 years postrelease) will be dependent on manpower availability and budget constraints. Ongoing studies through universities or other institutions could provide some levels of cost-effective monitoring.

5111. Census populations annually.

A prebreeding (late winter) census to estimate N_e (perhaps by snowtracking) and a summer census of litter production will be required.

5112. Investigate emigration, immigration, and dispersal.

It will be important to identify migration corridors and dispersal from release sites to assist in managing habitat peripheral to the reintroduction area. Range expansion could be documented by snow tracking or sampling.

5113. Refine existing population models.

Field data from the South Dakota and Wyoming studies should be reviewed in light of new approaches to analysis. Two models of black-footed ferret bioenergetics have been proposed (Stromberg et al. 1983, Powell et al. 1984.), and others are underway (S. Joyce, University of Wyoming, Department of Zoology). Assumptions underlying these models should be tested in the laboratory and field, and validated. Additional modeling which incorporates patch extinction rates from both simulated plague and canine distemper outbreak frequencies should be developed. Patch time to extinction models, such as those by Brussard and Gilpin (in press) with more explicit modeling of environmental "noise," should be accomplished. Metapopulation extinction models also need to be explored.

512. Establish protocols for demographic manipulation.

Goodman (1980) has described models and procedures for demographic intervention on small populations. This may be of concern for small reintroduction sites only.

513. Evaluate performance of genetic management.

The present objective is to maintain 90-percent heterozygosity for 200 years for the black-footed ferret. However, there is presently no test to demonstrate whether evolutionary

development is occurring. Management performance can only be evaluated by reviewing the metapopulation demography. Thus, it is important that management tactics, such as the migration of genetic material between population subdivisions, be carried out and documented carefully. If black-footed ferrets are to be exchanged at one individual/generation (Lacy and Clark in press) to ensure panmixia, exchange strategies (e.g., round-robin versus direct), timing, artificial versus natural introduction of semen or embryos, and administration need to be addressed.

514. Establish a clinic for black-footed ferret disease management.

Vaccination of reintroduced populations may prove too management-intensive or logistically not be feasible. A vaccine to provide long-term immunity to reintroduced individuals may help the success of efforts to reestablish a breeding population of ferrets in the wild. Future epizootics in free-ranging populations should be allowed to proceed without interruption (assuming one or more secure populations are extant) to identify natural resistance in black-footed ferrets if it exists. The improvement in our knowledge from observing various cases of epizootics in reintroduced populations could lead to future management prescriptions to diminish the effects of canine distemper and other diseases in ferrets. In the meantime, as much knowledge as possible should be gained from studies of canine distemper epizootics.

5141. Investigate canine distemper ecology and epizootiology in carnivores within black-footed ferret range.

At Meeteetse, some coyotes and badgers demonstrated serum-antibody response after the canine distemper epizootic in black-footed ferrets and may have been involved in it (Williams et al. in press). By understanding distemper dynamics in wild carnivores within black-footed ferret range, the timing and intensity of outbreaks may become predictable. If conditions or timing suggest incipient outbreaks in carnivore associates, management prescriptions could be developed to reduce outbreak severity.

5142. Understand canine distemper dynamics by following outbreaks in reintroduced black-footed ferret populations.

Natural epizootics should be fully documented to provide a greater understanding of disease flow through ferret populations.

5143. Explore ecological strategies employed by species of the subgenus Putorius to avoid species decline from canine distemper outbreaks.

European and Asian polecats are also highly sensitive to canine distemper, yet neither are endangered. This suggests an "ecological" resistance that could be explained by differences in life history, behavior, or environment. Knowledge of polecat ecology might be used in black-footed ferret management to reduce the number of local extinctions caused by disease. A complete review of existing knowledge should be made.

5144. Develop single dose vaccine to immunize black-footed ferrets for canine distemper.

A single dose vaccine should be developed that will provide lifetime immunity to captive and reintroduced black-footed ferrets from canine distemper. Black-footed ferrets not suitable for captive breeding or reintroduction into wild habitats may be useful as experimental animals for testing and development of this vaccine.

5145. Explore potential for widely distributed oral vaccines.

Aerial distribution of bait vaccines has been attempted with rabies. Similar technologies might be applied to control diseases in ferrets or the general carnivore community.

515. Establish policies for prairie dog disease management.

Maguire and Clark (1985) presented a decision analysis model for outbreak of plague in the Meeteetse prairie dogs that may be useful in future outbreaks. Intervention may be necessary if reintroduction sites are limited. Alternative sites which are not stocked with black-footed ferrets should be identified for stocking if one or more of the primary sites collapse and cannot recover. Modeling under Task 2113 should be used to identify a likely extinction scenario.

52. Enforce all laws protecting established populations.

Protection of the black-footed ferret is important because of the impact the loss of a few animals could have on viability of reintroduced or existing populations. Protection includes enforcement of article IX of the Convention on International Trade In Endangered Species of Wild Fauna and Flora; the Act; and State laws protecting nongame or threatened and endangered species.

53. Develop restocking contingency plans to translocate free-ranging ferrets to other populations.

Periodically, animals will have to be moved between both captive and wild sites to ensure genetic mixing or resolve demographic problems. Translocation will be cheaper than captive maintenance and translocated animals will not have to be trained. Additionally, wild black-footed ferrets may have to be brought into captivity from time to time to meet captive population objectives.

531. Develop criteria for determining which animals are "surplus" from free-ranging populations.

Models derived from Task 41121 should describe age and sex components of black-footed ferret populations that are nonessential for black-footed ferret population maintenance.

532. Develop a procedure to contain the spread of disease between exchange populations.

Quarantine or other protocols will need to be devised to ensure that diseases are not inadvertently introduced from one population to another during exchanges. The simplest method will probably be to devise exchanges so that at most only two populations are at risk in any given exchange.

6. Establish organizational arrangements to accomplish tasks and increase communication.

Black-footed ferret recovery is complex and requires an organizational structure capable of meeting a diverse array of challenges (Clark and Cragun in press).

61. Form advisory and technical groups to identify problems and solutions.

From a policy and program standpoint, the Service has lead responsibility to ensure coordination and provide guidance for national recovery objectives. However, it is more efficient if task-specific groups or individuals address specific problems and devise solutions for them.

611. Coordinate regional planning through the Black-footed Ferret Interstate Coordinating Committee.

The Interstate Coordinating Committee was organized in 1987 to discuss and resolve general issues and problems relating to black-footed ferret recovery. This committee will provide a forum for discussion of information collected by the individual State working groups (see Task 612).

612. Encourage the formation of State working groups.

Responsibilities of State working groups include identifying appropriate black-footed ferret habitat and completing steps necessary to get black-footed ferrets reintroduced (see Tasks 21-24, and 5). State working groups should be composed of representatives from State and Federal agencies responsible for ferret management, and land managers with jurisdiction over major complexes of prairie dog colonies. The land management contingent will vary from State to State, and may include State agencies, (e.g., State lands departments, State parks), Federal agencies (e.g., National Park Service, Forest Service, Bureau of Land Management, Bureau of Indian Affairs, Defense Department) and private landowners.

613. Utilize a Captive Propagation Advisory Committee.

The existing committee is composed of the Service, Wyoming Department, and International Union for the Conservation of Nature. Extend membership to other facility participants when they are identified. Identify additional expertise to be called upon as needed.

614. Promote the exchange of scientific information and seek technical advice.

It is clear from the national attention toward black-footed ferrets that a broad arena of expertise could be called upon to help in the recovery effort. Given the amount of work addressed in this plan, every opportunity to spread the responsibilities and tasks needed to achieve recovery should be seized. As the recovery program develops, the community of scientists addressing recovery problems and solutions for this species will have to expand with the expanding population. It is important to attract the most competent and dedicated individuals to fill these roles as possible.

6141. Encourage adequate outside peer review of proposals and research.

The program will benefit from outside peer review that keeps research and management on a sound scientific footing. The frequent publication of research results in refereed journals will provide one avenue for outside review, but outside review should be solicited on all proposals as a matter of policy.

6142. Continue to hold workshops relevant to current problems in black-footed ferret management and biology.

Workshops have been held in South Dakota in 1971 and Wyoming in 1984 and 1986. Future workshops could address topics of importance to later phases of the program, such as reintroduction and management.

62. Develop a national constituency with a long-term resource commitment toward the black-footed ferret.

A national constituency will have much greater influence in supporting black-footed ferret recovery at the Federal legislative level and will provide a greater resource base to support large and complex programs than State or regional constituencies.

621. Build a local constituency in each State within the former range of the black-footed ferret.

Local constituencies are important because they may be called upon to support reintroduction within their geographic areas. If local constituencies are able to take pride in the success of the reintroduction effort, reintroductions are more likely to succeed.

6211. Ensure frequent publication of popular articles and updates in the media.

The Wyoming Department currently issues a quarterly ferret newsletter and has a media plan for black-footed ferrets (Wyoming Game and Fish Department 1987a). The constituency reached through these outlets must be broadened for greater support of black-footed ferret programs.

6212. Ensure distribution of available films and educational materials.

An excellent recent film by Ray Paunovich, Natural Image Films, Worland, Wyoming, is available through the National Audubon Society. Montana Department of Fish, Wildlife and Parks has a free slide show for schools and groups.

622. Provide an opportunity for people to experience black-footed ferrets firsthand.

The closer the public experience with ferrets, the more closely they will identify with, and support, conservation programs for the species.

6221. Develop education programs through captive facilities.

Because national recovery efforts must be supported nationally, captive facilities should be encouraged to develop educational programs around the black-footed ferret. The Wyoming Department has developed a conceptional plan for the Sybille Wildlife Research and Conservation Education Center.

6222. Establish a national wildlife refuge for grassland ecology.

A national wildlife refuge dedicated to public education about the importance of grassland ecology, using the interrelationships of black-footed ferrets, prairie dogs, and cattle or bison, would have beneficial results for ferret recovery. The public would have the opportunity to observe ferrets in the wild to better understand their ecological role.

623. Ensure that national conservation organizations are frequently updated through personal contact.

Interested individuals should be encouraged to communicate their concerns directly to conservation organizations. Agencies should make special efforts to keep conservation organizations apprised of their activities and enlist the support of those organizations for black-footed ferret programs.

624. Support the creation of a nonprofit organization with high credibility to focus attention on the species.

The possibility of establishing an organization to provide support for ferret programs nationally (similar to the Peregrine Fund) should be explored and individuals capable of running such an organization identified and solicited for their interest.

625. Support the Office of Technology Assessment's call for legislation to establish a National Biological Diversity Act.

An act requiring explicit goals for management of biological diversity (Office of Technology Assessment 1987) would legally mandate sufficient habitat requirements to provide continuing evolutionary development for black-footed ferrets. Such an act should be supported and encouraged by all participants in the black-footed ferret program. The National Forest Management Act of 1976 provides for biological diversity.

63. Formulate a funding strategy for national black-footed ferret recovery by 1989.

The scope of programs needed to recover the ferret will require substantial initial and ongoing investment of Federal, State, and private monies. The Service should develop a long-range funding strategy to conduct this work beyond the treatment given funding in the implementation schedule of this plan.

64. Review program progress toward recovery objectives annually or biannually.

A formal written assessment of progress toward reaching objectives should be produced annually or biannually. Responsibility for analysis and appraisal of progress to each point of the plan should be assigned, with specific individuals responsible for specific projects on an assigned schedule. External review should occur at longer intervals. External review could come from the advisory committees described in this plan or others. Standard review of projects funded with Section 6 funds could be incorporated as part of the internal audit. Responsibility of assigning tasks is left to the funding entities and coordination is through the Service.

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PART III

IMPLEMENTATION SCHEDULE

The following summary of tasks and program costs is provided as a general outline. Specific tasks and a funding strategy which is contingent on precise schedules called for within the plan should be developed by 1989 (see Task 63).

The implementation strategy is: (1) to build a consensus on recovery needs through broadening participation in the program, and (2) provide incentives to participants to complete tasks.

Program participation is to be broadened by: (1) establishing a number of captive facilities, thereby increasing the number of conservationists with a direct professional interest in black-footed ferret biology and the geographic scope of interest, (2) providing, through the Black-footed Ferret Interstate Coordinating Committee, a forum for coequal participation of States with an interest in black-footed ferret reintroduction and the opportunity for those States to share in the reintroduction process, and (3) defining the role of the Captive Breeding Specialist Group or other set of technical advisors. Efforts should be continued to make contacts with a larger arena of specialists who might be available to assist in ferret recovery.

The incentives to participation include: (1) allowing participating breeding facilities to make use of ferrets for educational or public relations purposes, (2) providing States with some means to more flexibly manage prairie dogs once key ferret habitats within the State have been identified, management plans have been developed, and protection plans implemented, and (3) allowing States full management discretion over ferrets in their State once national delisting objectives have been reached.

Definition of Priorities

- Priority 1 - All actions that must be taken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future.
- Priority 2 - All actions that must be taken to prevent a significant decline in species population/habitat quality, or some other significant negative impact short of extinction.
- Priority 3 - All other actions necessary to provide for full recovery of the species.

Definition of Task Duration

Ongoing - Task which is now being implemented.

Continuous - Task or action which will be required over a very long or undetermined period of time.

Abbreviations Used

Fish and Wildlife Service

2	Region 2 (Albuquerque, New Mexico)
6	Region 6 (Denver, Colorado)
CU's	Cooperative Fisheries and Wildlife Research Units
FWS	U.S. Fish and Wildlife Service
LE	Law Enforcement
NEC	National Ecology Research Center
NWHC	National Wildlife Health Center
OIA	Office of International Affairs
PAO	Public Affairs Office
RE	Realty
R-8	Region 8 (Research)
R-9	Region 9 (WO)
SE	Endangered Species
WCU	Wyoming Cooperative Fisheries and Wildlife Research Unit
WO	Washington Office

Others

APHIS	Animal and Plant Health Inspection Service
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
CBF	Captive Breeding Facility
CBSG	Captive Breeding Specialist Group
CDC	Centers for Disease Control
CWS	Canadian Wildlife Service
DOD	Department of Defense
FS	U.S. Forest Service
ISIS	International Species Inventory System
ICC	Black-footed Ferret Interstate Coordinating Committee
IUCN	International Union For the Conservation of Nature and Natural Resources
NCI	National Cancer Institute
NPS	National Park Service
NYZ	Bronx Zoo, New York Zoological Society
NZ	National Zoo
PLM	Private Land Managers
PWCG	Private Wildlife Conservation Group
SAA	State Agricultural Agencies
SCS	Soil Conservation Service
SEDUE	Secretaria de Desarrollo Urbano y Ecologia
SL	State Legislative Branch
SWA	State Wildlife Agencies; Arizona, Colorado, Kansas, Montana, Nebraska, New Mexico, North Dakota, Oklahoma, South Dakota, Texas, Utah, Wyoming
UID	University of Idaho

USC
USDI
uw
WGF

U.S. Congress
U.S. Department of the Interior
University of Wyoming
Wyoming Game and Fish Department

General Categories For Implementation Schedule

Information Gathering - I or R (research)

1. Population status
2. Habitat status
3. Habitat requirements
4. Management techniques
5. Taxonomic studies
6. Demographic studies
7. Propagation
8. Migration
9. Predation
10. Competition
11. Disease
12. Environmental contaminant
13. Reintroduction
14. Other information

Management - M

1. Propagation
2. Reintroduction
3. Habitat maintenance and manipulation
4. Predator and competitor control
5. Depredation control
6. Disease control
7. Other management

Acquisition - A

1. Lease
2. Easement
3. Management agreement
4. Exchange
5. Withdrawal
6. Fee title
7. Other

Other - O

1. Information and education
2. Law enforcement
3. Regulations
4. Administration

IMPLEMENTATION SCHEDULE FOR BLACK-FOOTED FERRET

General Category (1)	Plan Task (2)	Task # (3)	Priority # (4)	Task Duration (5)	Responsible Agency			Fiscal Year Costs (Est.)			Comments/Notes (9)
					FWS		Other	FY-1 (8)	FY-2	FY-3	
					Region (6)	Program (6a)	(7)				
M1	Establish 5 captive populations located in 3 locations	111 1111	1 1	2 yr	6	SE	WGF	5K	5K	--	National organizations will serve in advisory & cooperative capacity
M1	Divide populations	1112	1	2 yr	6	SE	WGF	7K	7K	--	Search committees of State, Federal & national organizations review & recommend site for captive breeding
02.03.04	Administer populations	1113 1114	1 1	continuous	6	SE	WGF	1K	1K	1K	CBSG will serve in advisory & cooperative capacity
M6	Devise protection protocols	112 113 114	1 1 1	ongoing	6	SE	WGF	--	--	--	Administrative costs to cooperating institutions
R11	Investigate vaccines	11511 11512	2	ongoing	6 . 8	SE,NEC	WGF	10K	10K	10K	University 6 laboratories may investigate under contract
R11	Document and study other diseases	1152	3	ongoing	6.6	SE,NEC	UGF	--	--	--	Administrative costs
M1	Increase number of founder animals from Heeteetse	1211	1	completed 1987	6.8	SE,NEC	WGF	--	--	--	No further activity anticipated
M1	Ensure all individuals are involved in contributing genetic material	1212	1	ongoing	6.8	SE	WGF	--	--	--	Administrative costs to cooperating institutions

IMPLEMENTATION SCHEDULE FOR BLACK-FWTEO' FERRET

General Category (1)	Plan Task (2)	Task # (3)	Priority (4)	Task Duration (5)	Responsible Agency			Fiscal Year Costs (Est.)			Comments/Notes (9)
					Region (6)	FWS Program (6a)	Other (7)	FY-1 (8)	FY-2	FY-3	
R7	Artificial means to capture genetic contribution and improve breeding strategies	1213	1	ongoing	6,8	SE,NEC,WCU	WGF,UW	--	--	--	Cost not determined
		12131	1	ongoing	6,8	SE,NEC,WCU	WGF,UW	5K	5K	5K	CBSG acts in advisory role
		12132	1	ongoing	6,8	SE,NEC,WCU	WGF,UW,UID,NZ	5K	5K	5K	
		12133	1	unknown	6,8	SE,NEC	WGF,UID	--	--	--	Cost not determined
		1214	1								
		12141	1	ongoing	6,8	SE,NEC	WGF	10K	5K	5K	
		12142	1	ongoing	6,8	SE,NEC,WCU	UU, UGF, NZ	10K	5K	5K	
		12143	1	ongoing	6,8	SE,NEC,WCU	UU, UGF, UID, NZ	10K	5K	5K	
		12144	1	unknown				--	--	--	Cost not determined
		12145	1	unknown	6,8	SE,NEC,WCU	WGF,UW	--	--	--	Cost not determined
M1	Assess and merge new geographic stock	1215	1	continuous	6,8	SE,NEC	UGF, SUA	--	--		Budget to be determined
		12151			6,8	SE,WCU,NEC	UGF, NCI				New facilities in FY88 & FY89
		12152			6	SE	UGF				CBSG acts in advisory role
M1	Minimize relatedness among mates and make all attempts to ensure at least 7 offspring from each pair	1221	1	ongoing	6	SE	UGF	See Task 13			CBSG acts in advisory role
		1222	1			SE	WGF				
R7	Utilize genetic contribution Cryopreservation of semen Cryopreservation of ovas	1223	3	3 yr	6,8	SE,NEC,WCU	UGF, UW, NZ	--	--	--	CBSG acts in advisory role
		12231		2 yr	6,8	SE,NEC	WGF,UW, NZ	--	15K	15K	Administrative costs
		12232		2 yr	6,8	SE,NEC	WGF,UID, NZ	--	15K	15K	
M1	Ensure migration of genetic material	1224	1	continuous	6	SE SE,NEC	WGF, CBF	140K	210K	280K	CBSG acts in advisory role
R7	Evaluate genetic diversity at nucleic acid level	1231	3	3 yr	6,8	SE,NEC,WCU	UGF, NCI	15K	15K	15K	

IMPLEMENTATION SCHEDULE FOR BLACK-FOOTED FERRET

General Category (1)	Plan Task (2)	Task # (3)	Priority # (4)	Task Duration (5)	Responsible Agency			Fiscal Year Costs (Est.)			Comments/Notes (9)
					FWS		Other	FY-1 (8)	FY-2	FY-3	
					Region (6)	Program (6a)	(7)				
16	Keep records on all individuals	1232	1	continuous	6	SE	WGF, CBF	--	--	--	Administrative costs
		12321	1	continuous	6	SE	WGF, CBF	--	--	--	Administrative costs
		12322	1	continuous	6	SE	WGF, CBF	1K	3K	3K	
	Duplicate record-keeping	12323	1	continuous	6	SE	WGF, CBF, ISIS	2K	1K	1K	Central data storage & retrieval system should be established
		12324	2	continuous	6,8	SE, NEC	WGF, CBF	3K	3K	3K	
		12325	2	continuous	6	SE	WGF, CBF	2K	2K	3K	
M1	Develop a program to identify individual characters	1233	3	continuous	6	SE	WGF, CBF	--	--	--	Administrative costs
M1	Provide environment conducive to ferret reproduction and survival	13	1	ongoing	6	SE	WGF, CBF	140K	210K	280K	New facilities in FY-88 & FY-89
R?	Develop dietary protocol	131	1	1 yr	6,8	WCU, SE, NEC	WGF, NYZ, UW	7K	--	--	CBSG acts in advisory role
		1311	1		6,8	WCU, SE, NEC	WGF, NYZ, UW				
		1312	1		6,8	WCU, SE, NEC	WGF, CBF, NYZ, UW				
M1	Develop lighting and husbandry protocols	132	1	ongoing	6		WGF, CBF	2K	4K	2K	CBSG acts in advisory role
		133	1	ongoing	6	3:	WGF, CBF	See Task 13			
		1331	1		6	SE	WGF, CBF	See Task 13			
		1332	1		6	SE	UGF, CBF				
		1333	1		6	SE	WGF, CBF				
M1	Establish surrogate populations	141	1	ongoing	6	SE	WGF, CBF	3K	3K	3K	CBSG acts in advisory role
M7	Establish policies for nonreproductive ferret	142	3	ongoing	6	SE	WGF	--	--	--	CBSG acts in advisory role Cost not determined
M3, R3	Define potential ferret habitat for recovery by 1988	21	1	1 yr	6,2	SE	SUA, SAA, BLM, NPS, BIA, SCS	2K	--	--	ICC will coordinate with SWA

IMPLEMENTATION SCHEDULE FOR BLACK-FOOTED FERRET

General Category (1)	Plan Task (2)	Task # (3)	Priority # (4)	Task Duration (5)	Responsible Agency			Fiscal Year Costs (Est.)			Comments/Notes (9)
					Region (6)	FUS Program (6a)	Other (7)	FY-1 (8)	FY-2	FY-3	
M3	Determine the distribution of prairie dogs defined as black-footed ferret recovery habitat in Task 21 by 1989	22	1	1 yr	6.2	SE	SWA, SAA, BLM, NPS FS, BIA, SCS	--	--	--	ICC will coordinate with SUA Costs not determined
M3	Assign and agree on mapping responsibility and data needs in each State	221 2211	1 1	2 yr	6.2	SE	SWA, SAA, BLM, NPS FS, BIA, SCS	--	--	--	ICC will coordinate with SWA Cost not determined
12	Compile mapping data	2212 22121 22122	1	2 yr	6.2	SE	SWA, SAA, BLM, FS, BIA, SCS	150K	150K	--	ICC will coordinate with SWA
12	Develop distribution in foreign countries	222 2221 2222 2223	3	continuous	8,9 6,2	NEC, OIA SE	CUS SE, WGF	--	--	--	International conservation organizations will be contacted. Costs undeter- mined
113	Develop a plan for reintroducing sites	23	2	2 yr	6	SE	SWA, SAA, BLM, FS, BIA, SCS, FUS, PLM NPS	2K	2K	--	ICC will coordinate with SWA
M3	Identify prairie dog colonies, potential for expansion, and target levels	241 2411 2412 2413	1 1 3 1	ongoing	6.2	SE	BLM, BIA, FS, FUS, SWA, SM, PLM, NPS	SCS, 10K	10K	10K	Interstate Coordinating Com- mittee will provide oversight & coordination of State working groups
M3	Determine patterns and occurrences of plague	24141	3	ongoing	6.2	SE, UCU	SWA, SAA, BLM, FS, BIA, SCS; NPS UW	2K	5K	5K	
R11 95	Plague impacts, pattern, and processes	24142 241421 241422	2	ongoing	8	NEC	CDC	SK	15K	15K	

IMPLEMENTATION SCHEDULE FOR BLACK-FOOTED FERRET

General Category (1)	Plan Task (2)	Task # (3)	Priority # (4)	Task Duration (5)	Responsible Agency			Fiscal Year Costs (Est.)			Comments/Notes (9)
					Region (6)	FWS Program (6a)	Other (7)	FY-1 (8)	FY-2	FY-3	
M3	Plan and schedule manipulation of prairie dogs	2415	3	continuous	6.2	SE	SUA, SM, BLM, FS, BIA, SCS, NPS	--	--	--	ICC will coordinate with State working groups Cost not determined
M3	Establish cooperative management agreements with public & private landowners.	2416	1	continuous	6.2	SE	SWA, SM, BLM, FS, 81A, SCS, NPS	--	--	--	ICC will coordinate with State working groups Cost not determined
M3	Determine livestock use levels	24151	3	continuous	6.2	SE	SWA, SAA, BLM, FS, 81A, SCS, NPS	--	--	--	ICC will coordinate with State working groups Cost not determined
R4	Techniques for increasing prairie dog population	24152	3	continuous	6.2	SE	SWA, SAA, BLM, FS, BIA, SCS, NPS	--	--	--	Administrative costs Available from literature Cost not determined
R4	Techniques for control of prairie dog population	24153 241531 241532	3	continuous	6.2	SE	APHIS	--	--	--	Mostly completed-available from literature Cost not determined
M3	Establish cooperative agreements	2416	3	continuous	6	SE	SWA, SM, BLM, FS, 81A, SCS, NPS	--	--	--	Administrative costs
I/R2, I/R11, I/R10, I/R9	Collect baseline information on reintroduction sites	242 2421 2422 2423 2424	3	continuous	6.8	SE, NEC, WCU	NEC, SWA, SAA, BLM, FS, BIA, SCS	15K	20K	20K	ICC will coordinate with State working groups
O3	Evaluate legal and procedural obligations	243 2431 2432 2433 2434 2435	3	2 yr	6.2	SE, LE		--	--	--	USDI Solicitors Office will advise. Administrative costs

IMPLEMENTATION SCHEDULE FOR BLACK-FOOTED FERRET

General Category (1)	Plan Task (2)	Task # (3)	Priority # (4)	Task Duration (5)	Responsible Agency			Fiscal Year Costs (Est.)			Comments/Notes (9)
					Region (6)	FWS Program (6a)	Other (7)	FY-1 (8)	FY-2	FY-3	
0 3	Modify State statutes	2441	3	continuous			SL, SWA, SM	--	--	--	Administrative costs Rills must be introduced
AI-6	Acquire habitat	2442 24421 24422	3		6.2	SE,RE		--	--	--	Cost not determined PWCG's should assist
12	Model cumulative effects	2443	3	continuous	6,2	SE	SWA, APHIS	5K	5K	5K	Expenses associated with prairie dog management planning
01	Information and educa- tion for reintroduction	245 2451 2452 2453 2454	3	continuous	6	SE,PAO	SWA, BLM, FS,BIA, NPS,PLM	5K	5K	5K	ICC will coordinate with State working groups. PWCG's should assist.
M3	Implement plan	246	1	continuous	6,2	SE	SWA, SAA, PLM, BLM FS, BIA, NPS	--	--	--	Cost not determined
M7	Adapt a system for eval- uating reports	311	3	ongoing	8	NEC	SWA	--	--	--	Administrative costs
I1	Search for ferrets on a priority basis	312 3121 3122	2	ongoing	8	NEC	SWA,BLM, FS, BIA, NPS	85K	77K	82K	
01	Conduct training workshop	313	3	ongoing	6.8	SE,WCU	UW	--	--	--	Self-supporting through fees
01	Offer a reward	321	2	ongoing	8	NEC	NYZ. SWA	5K	5K	5K	
01	Continue information and education	322	3	ongoing	6	SE PAO	SWA, BLM, FS, BIA, 2K NPS		2K	2K	PWCG's should assist

IMPLEMENTATION SCHEDULE FOR BLACK-FOOTED FERRET

General Category (1)	Plan Task (2)	Task # (3)	Priority # (4)	Task Duration (5)	Responsible Agency			Fiscal Year Costs (Est.)			Comments/Notes (9)
					FWS		Other	FY-1 (8)	FY-2	FY-3	
					Region (6)	Program (6a)	(7)				
03	Ensure use of current FWS guidelines or their equivalent	331 3311 3312 3313	3	continuous	6,8	SE,WCU	SWA, BLM, FS, BIA, NPS	--	--	--	Administrative costs Administrative costs Administrative costs Administrative costs
R14	Explore potential for chemical attractants	3321	3	1 yr	8	NEC,WCU		--	10K	--	
R14	Establish feasibility of gas chromatography, HPLP, and mass spec methods for scats	3322	3	1 yr	8	NEC		--	—	--	Funded, study in progress
R14	Improve aerial surveys	3323	3	1 yr	8	NEC		5K	--	--	Detectability of ferret sign (simulations)
R14	Model practicability of spotlighting	3324	3	1 yr	8	NEC		5K	--	--	
R14	Improve understanding of digging	3325	3	1 yr	8	NEC		16K	--	--	
R14	Test use of dogs	3326	3	1 yr	8	NEC		--	10K	--	
M7	Develop contingency plans for action	34 341 342 343 344	 3 3 3 3	ongoing ongoing ongoing ongoing	6,2 6,2 6,2 6,2 6,2	SE SE SE SE SE	SYA SWA SUA SWA,SAA,BLM,FS,BIA NPS.SCS SUA	-- -- -- -- --	-- -- -- -- --	-- -- -- -- --	ICC will promote adoption of plan. Cost not determined.
M2	Prepare reintroduction schedule	411	1	1 yr	6	SE	WGF, CBF, SWA	5K	--	--	CBF's and ICC will coordinate with land managers

IMPLEMENTATION SCHEDULE FOR BLACK-FOOTED FERRET

General Category (1)	Plan Task (2)	Task # (3)	Priority # (4)	Task Duration (5)	Responsible Agency			Fiscal Year Costs (Est.)			Comments/Notes (9)	
					FWS		Other	FY-1 (8)	FY-2	FY-3		
					Region (6)	Program (6a)	(7)					
M3	Prepare priority sites	4111	1	2 yr	6.2	SE	SWA, BLM, FS, BIA, NPS, PLM, SCS, SAA	-	-	7K	7K	
M2	Schedule ferret stock for release	4112 41121 41122	1 1 1	ongoing	6.2	SE	WGF, CBF	--	--	--		Cost not determined. CBSG may suggest demographic & genetic expertise
M2	Develop criteria for abandoning attempts at a sites	4113	3	1 yr	6	SE, NEC	WGF, SUA	--	--			CBSG serves in advisory capacity to Region 6 & State Wildlife Agency. Cost not determined.
R4	Develop conditioning techniques	412 4121	2	continuous	B	NEC	WGF, CBF	--	--	--		Cost not determined
R4	Build training areas	41211	3	ongoing	6	SE	UGF	12K	12K	12K		
R4	Familiarization with prey and killing	41212	2	2 yr	6	SE, UCU	WGF	--	4K	4K		
R4	Predator avoidance	41213	2	2 yr	6,8	SE, NEC, WCU	WGF	--	4K	4K		
M2	Adapt training strategy	4122	3	1 yr			WGF, CBF	--	--	--		Cost not determined
R13	Develop experimental de- signs for releases	413	1	1 yr	6,8	SE, WCU, NEC	WGF	--	4K	--		
R13	Compare hard versus soft release techniques	4131 41311 41312	1	1 yr	6,8	SE NEC WCU	UGF	--	--	2K		
M4	Determine need for habitat modification	4132	2	1 yr	6,8	SE NEC CU's	UGF SUA	--	--	2K		literature review

IMPLEMENTATION SCHEDULE FOR BLACK-FOOTED FERRET

General Category (1)	Plan Task (2)	Task # (3)	Priority (4)	Task Duration (5)	Responsible Agency			Fiscal Year Costs (Est.)			Comments/Notes (9)
					FWS		Other	FY-1 (8)	FY-2	FY-3	
					Regio (6)	Program (6a)	(7)				
R6	Improve radio-telemetry	4141	1	ongoing	8	NEC		3K	3K	3K	
R4	Improve censusing techniques	4142	3	1 yr	B	NEC, WCU	SUA	--	--	3K	
R6	Investigate methods to identify individuals	4143 41431 4 1 4 3 2 41433	3	2 yr	6,8	SE, NEC	WGF, CBF	--	--	--	Cost not determined
R13	Conduct experimental releases	42	1	2 yr	6,8	SE NEC CU's	WGF, SWA	--	--	--	Cost not determined
R13	Evaluate reintroduction success	43	1	3 yr	6.1	SE NEC	WGF, SWA	--	--	--	Administrative cost
A1	Census populations	431	1	3 yr	6.8	SE NEC CU's	WGF, SWA	--	--	--	Cost not determined
R6	Investigate natality and mortality	432	1	3 yr	6.8	SE CU's NEC	WGF, SWA	--	--	--	Cost not determined
RB	Investigate immigration, emigration and dispersal	433	1	3 yr	6,8	SE CU's NEC	WGF, SWA	--	--	--	Cost not determined
R3	Investigate home range	434	1	3 yr	6,8	SE NEC CU's	WGF, SWA	--	--	--	Cost not determined

IMPLEMENTATION SCHEDULE FOR BLACK-FOOTED FERRET

General Category (1)	Plan Task (2)	Task # (3)	Priority (4)	Task Duration (5)	Responsible Agency			Fiscal Year Costs (Est.)			Comments/Notes (9)
					FWS		Other	FY-1 (8)	FY-2	FY-3	
					Region (6)	Program (6a)	(7)				
R9	Investigate interspecific reactions	435	1	3 yr	6,8	SE NEC CU's	WGF,SWA	--	--	--	Cost not determined
R3	Evaluate observed changes in habitat	436	1	3 yr	6,8	SE NEC CU's	SWA, BLM, FS, BIA, NPS	--	--	--	Cost not determined
M2	Conduct operational releases	44 441 442	1 1 1	12 yr	6	SE	SUA, WGF, CBF	--	--	--	Cost not determined
M2	Monitor ferrets	51 511 5111 5112 5113	2 2 2 2 2	continuous	6	SE	SUA, BLM, FS, NPS, BIA	--	--	--	Cost not determined'
M2	Establish protocols for demographic manipulation	512	2	continuous	6	SE	UGF, CBF, SWA	--	--	--	CBSG may suggest demographic expertise. Cost not determined
M7	Evaluate performance of genetic management	513	2	continuous	6	SE	WGF, CBF, SWA	--	--	--	CBSG may suggest genetic expertise, Cost not determined
M6	Establish policies for ferret disease management	514	2	continuous	6	SE	WGF, SUA, UW	--	--	--	Cost not determined
R11	Investigate canine distemper ecology	5141	2	3 yr	6,8	SE NEC NUHC	WGF, SUA, UW	BK	BK	BK	
R11	Observe canine distemper outbreaks	5142	2	continuous	6	SE NEC NUHC	WGF, SWA, UW	--	--	--	Cost not determined

IMPLEMENTATION SCHEDULE FOR BUCK-FOOTED FERRET

General Category (1)	Plan Task (2)	Task # (3)	Priority # (4)	Task Duration (5)	Responsible Agency			Fiscal Year Costs (Est.)			Comments/Notes (9)
					Region (6)	F Y S	Other (7)	FY-1 (8)	FY-2	FY-3	
						Program (6a)					
R11	Investigate ecological strategies used by related species to resist decline	5143	3	3 yr	B	NEC CU's NWHC	MGF, UW	11K	80K	85K	
All	Develop single dose vaccine for canine distemper	5144	1	continuous	6,8	NEC NWHC	MGF, UW	--	--	--	Cost not determined
R11	Explore potential for widely distributed oral vaccines	5145	2	continuous	6,8	NEC CU's	UGF, SUA, UW	--	--	--	Cost not determined
M6	Establish policies for prairie dog disease management	515	3	continuous	6,8	SE	SUA, CDC, UW	--	--	--	To be developed
02	Enforce all laws protecting established populations	52	3	continuous	2,6	LE SE	SWA	SK	5K	5K	
M1,M2,M6	Develop plans to restock populations from other wild populations	53 531 532	2 2 2	1 yr	6,8	SE NEC	UGF, SWA	--	--	--	Cost not determined
04	Coordinate regional planning through ICC	611	2	ongoing	6	SE	SWA	5K	5K	5K	
04	Form State working groups	612	3	ongoing	6	SE	SWA,SAA,BLM,FS,BIA SCS,DOD,NPS	--	--	--	Interstate Working Group will coordinate & facilitate Cost not determined
04	Formalize the existing relationship between FWS, MGF, IUCN, and others	613	2	ongoing	6	SE	MGF, SWA, PUCG	8K	BK	BK	

IMPLEMENTATION SCHEDULE FOR BLACK-FOOTED FERRET

General Category (1)	Plan Task (2)	Task # (3)	Priority # (4)	Task Duration (5)	Responsible Agency			Fiscal Year Costs (Est.)			Comments/Notes (9)
					Region (6)	US Program (6a)	Other (7)	FY-1 (8)	FY-2	FY-3	
01	Promote exchange of scientific information workshops	614 6141 6142	3	ongoing	6	S E	WGF,SWA	--	--	--	Variable costs Partially recovered expenses (registration fees, etc.)
01	Publish popular articles	6211	3	ongoing	6,8	SE NEC	SWA, PUCG	1K	1K	1K	
01	Distribute films and educational material	6212	3	ongoing	6,8	SE, PAO NEC	SWA,WGF	1K	1K	1K	
01	Develop education programs through captive facilities	6221	3	continuous	6	SE PAO	WGF, PWCG, CBF's	2K	2K	2K	
01	Establish a national refuge for grassland ecology	6222	3	continuous	6	SE,RE	PUCG	--	--	--	To be developed
01	Update national conservation organizations	623	3	continuous	6	SE,PAO	WGF,SWA	--	--	--	Administrative costs
01	Develop a nonprofit support organization	624	3	continuous	6	SE	SWA,PWCG	10K	10K	50K	
01	legislate for a National Biological Diversity Act	625	3	continuous	W0		USC	10K	10K	10K	
04	Develop a funding strategy for 1989	63	1	1 yr	W0		SWA,WGF,PWCG	--	--	--	Cost not determined
04	Review program progress	64	2	continuous	6	SE	WGF,SWA	5K	5K	5K	CBSG will advise & ICC will provide coordination

APPENDIX I.

BLACK-FOOTED FERRET SURVEY GUIDELINES FOR COMPLIANCE WITH
THE ENDANGERED SPECIES ACT.

BLACK-FOOTED FERRET
SURVEY GUIDELINES FOR
COMPLIANCE WITH
THE ENOANGERED SPECIES ACT

U. S. Fish and **Wildlife Service**
Denver, Colorado and
Albuquerque, New **Mexico**

March 12, 1986

Compliance with or disregard for these guidelines does not, of itself, show compliance with or violation of the Endangered Species Act or any derived regulations. It is advisable that the appropriate State wildlife agency or field supervisor, FWS, be contacted if there are any questions about an activity to be conducted in black-footed ferret habitat.

GUIDELINES FOR BLACK-FOOTED FERRET SURVEYS

INTRODUCTION

These guidelines have been prepared to assist lead agencies or their authorized representatives in designing surveys to "clear" prairie dog towns prior to initiation of construction, prairie dog control projects, or other actions. They are also intended for use by FWS personnel, as well as any other State, Federal, or private agency or organization interested in conducting ferret surveys.

These guidelines are also intended to assist these agencies or organizations in designing surveys in areas suspected of maintaining a ferret population, but without confirmed or recent sightings. If a proposed action is planned in a part of the ferrets' range where data indicate that ferrets are likely to exist (i.e., counties or townships where sightings are frequently reported or where confirmed sightings have been made), the limits on prairie dog town size and exclusions described in these guidelines will not apply. To determine whether the limits and exclusions apply to the area proposed for a planned action the lead agency should consult with the appropriate FWS Endangered Species Office.

BACKGROUND

The Endangered Species Act (ESA), as amended, requires Federal agencies to ensure that any action authorized, funded, or carried out by them is not likely to jeopardize the continued existence of a threatened or endangered species. Regulations implementing Section 7 of ESA require Federal agencies to determine if their proposed action "may affect" any threatened or endangered species. If it is determined that the proposed action "may affect" an endangered or threatened species, then the agency is required to request formal Section 7 consultation with the Fish and Wildlife Service (FWS).

The Black-footed ferret (*Mustela nigripes*) is a federally listed endangered species which normally depends upon prairie dog towns for a source of food and shelter. Ferrets are difficult to find and observe because they are secretive, subterranean animals whose above-ground activity is relatively brief and predominantly nocturnal.

Actions which kill prairie dogs or alter their habitat could be detrimental to ferrets that occupy prairie dog towns. This necessitates that we determine to the best of our ability if ferrets are present in a proposed action or project area to determine if the action "may affect" the species. To help detect ferret presence on a prairie dog town, the FWS has prepared the following guidelines. If persons conducting black-footed ferret surveys judiciously follow these guidelines, agency decision-makers can be reasonably confident as to whether black-footed ferrets presently occupy a proposed project area. A survey for ferrets will supplement the consultation process but does not relieve any agency of their Section 7 consultation obligations.

SURVEY CRITERIA

Delineation of Survey Areas

The FWS **recommends** surveys for ferrets on all projects or actions that involve Isolated prairie dog towns of **250** acres or more or that pass through a complex of smaller **prairie** dog towns that, combined, could support a ferret population. Recent research has shown that adult and young ferrets can move for distances of over **4 miles** in one night. To determine if a complex exists, the center of the prairie dog town to be affected should be considered the center of a circle **4.5 miles** in radius. If the **combined** area of all prairie dog towns **within** this **circle** totals **250** acres or more, the affected prairie dog town should be surveyed **following** the procedures described in this document.

When additional data for black-footed ferrets become available, these **criteria** will be refined to **indicate** a minimum-density prey base or be modified to more accurately describe the **size** of **black-tailed** or **white-tailed** prairie dog towns needed to support **individual** animals or populations of black-footed ferrets.

Timing of Surveys

The **FWS recommends** that surveys for ferrets be conducted as close as possible to the initiation of a project. **This is recommended** to minimize chances of missing a ferret that might move onto the area during the period between completion of surveys and development. Construction projects requiring **1 year** or less for completion should be surveyed for the presence of black-footed ferrets within **1 year** before construction **begins**. A project that occurs in several increments and requires more than **1 year** for completion, such as a coal strip mine, would need a survey for ferrets on all prairie dog towns in the full project area (including the half-mile strip bordering the project) before initiating the first annual increment. Thereafter, only that part of the project area and the half-mile border strip being developed each **succeeding** year would be surveyed prior to each year of impact.

Project Type

Construction projects - Both linear and spatial developments **that permanently** alter prairie dog **towns** (buildings, facilities, surface coal **mines**, **powerlines**, roadways, large **pipelines**, impoundments, etc.) should be surveyed. The area to be surveyed should include all prairie dog towns occurring on a project right-of-way and those towns or parts of **towns** found within one-half mile of the construction site or right-of-way border. Projects of a temporary nature that involve only minor **disturbance** (e.g. fences, some transmission lines, underground cables, etc.) may be exempted from surveys **when** project **activities** do not impact those areas where ferret sightings have been **frequently** reported or where **confirmed** sightings have been made in the last **10 years**. To determine whether a project qualifies for exemption, the lead agency must contact the appropriate **FWS** Endangered Species Field or Regional Office.

Pesticide or toxicant use - The **FWS recommends** that before any action involving the use of toxicants in or near prairie dog towns begins, a survey of the area should be conducted. This includes all prairie dog towns proposed for control. If phosphide-treated **grain**, gas cartridges, or tablets are the central agent, then the area to be surveyed should include the prairie dog town where the proposed **action** is located, and any other town or portion of a town within one-half mile of the boundary of the town proposed for treatment. If the proposed control agent involves the use of any other compound including those under **registration** with the Environmental Protection Agency, then the area to be surveyed for ferrets should include the prairie dog town to be treated and any other town or portion of a town within 1 mile of the town being treated with the **toxicant**. This **difference** is justified on the **basis** of potential hazards to ferrets caused by secondary **poisoning**, known ferret mobility, and observations of ferrets taking **carcass**. Radio-collared black-footed ferrets have been observed to move over an area of about 800 acres in a single night, and the **species** is known to feed on all parts of a dead prey carcass.

SELECTION OF SURVEY METHOD

Under these guidelines, there are two recommended methods to survey for ferrets or ferret sign. These are based upon the **most recent** survey data, and both involve specific **time** periods.

Diurnal (daylight) surveys for ferrets are recommended if surveys are conducted between December 1 and March 31. This type of survey is used to locate sign left by ferrets. During winter months, ferret tracks, **scats**, skulls, and **diggings** are more abundant and obvious because **prairie dogs** are less active and less likely to **disturb** or destroy ferret sign.

If followed as **recommended**, daylight searches for ferret sign should meet the following criteria to fulfill the minimum standards of these guidelines:

1. Search must be conducted between December 1 and March 31, but not more than 1 year before prairie dog control or construction is started.
2. Three searches must be made on each town with at least a 10-day interval between searches. (In late fall, radio-tagged ferrets have remained underground for up to 8 days on the **Meeteetse**, Wyoming, study area.)
3. On bare ground (no snow cover), surveyors must make hole-to-hole **inspections** for sign.
4. Following fresh snowfall, vehicles may be used to search for tracks or ferret **diggings**, but complete **visual** inspection of each portion of the town surveyed is required (i.e. visually overlapping transects).
5. If ferret sign is observed, the prairie dog colony and any portion of the colony that extends beyond the project boundary should be surveyed **using** the spotlight methods described in Section 2 of the night search method.

Nocturnal(nighttime) surveys Involve the use of **spotlighting techniques for locating** ferrets. This survey method is designed to locate ferrets when the maximum population is expected **to exist**. Night surveys are **recommended** for the period July 1 to October 31. At **this** time, litters become active above ground at night, and as fall approaches, **littermates** establish **independence** from the mother. Research has shown a marked decrease in ferret activity and/or sign above ground **in November**, April, and May. **Expending** resources to find ferrets during these months **is not recommended**, because no acceptable confidence can be placed on the results of surveys conducted during this period.

If followed as **recommended**, specific criteria for meeting **minimum FWS standards** for nocturnal surveys include:

1. Surveys should be conducted between July 1 and October 31, but not more than **1** year before prairie dog **control** or construction begins.
2. The prairie dog town should be continuously surveyed by spotlighting during the hours between dusk and dawn on each of 3 consecutive nights. Depending on vegetation and terrain, large prairie dog colonies should be divided into tracts **of** 320 acres and systematically searched. During each night of search, the prairie dog town or tract should be searched three **different** times; e.g., the **town** might be searched from dusk to 10 p.m., again from 11 p.m. to 1 a.m., **and** a third time from 3 a.m. to **5** a.m. on each of three **consecutive** nights.
3. Observations on each prairie dog town or tract searched should begin at a different starting point on each successive night to maximize the chance of overlapping black-footed **ferrets' nighttime** activity period.
4. A survey crew consists of one vehicle and two observers equipped with one or two 200 to 300 thousand candlepower spotlights. In terrain not **suitable** for **vehicles**, a crew **will consist** of two **individuals** working on foot **with** battery-powered 200 to **300** thousand candlepower spotlights.

Survey Reports

The following outline provides a general **summary of the** types of information useful to the **FWS** in reviewing the results of ferret surveys for concurrence with an agency's decision of "may affect" or "**no affect.**" This report will be used to assist in **Section 7 compliance** decisions. Headings listed can be used in field data forms to ensure that all pertinent data are collected and surveys are not unnecessarily repeated. It is **recommended** that a report **summarizing** survey data be prepared for each project and submitted to the lead agency and to the appropriate **FWS** Endangered Species Field or Regional Office.

Night Search (July 1 to October 31) or Daylight Search (December 1 to March 31)

- (1) Date
- (2) Hours spent searching (times started - stopped)
- (3) Acres searched
- (4) Number of colonies searched
- (5) Number of burrows inspected
- (6) Ferrets or ferret sign observed and locations
- (7) Photos taken
- (8) Searchers' names
- (9) Weather conditions (Include If bare ground or snow)
- (10) Method of search (backpack, vehicle, foot)
- (11) Mapped survey route and location of prairie dog town

Survey Summary

- (1) Starting and completion dates for the survey
- (2) Total hours of spotlight search
- (3) Total acres spotlight searched
- (4) Total colonies spotlight searched
- (5) Total ferrets observed and locations by night search
- (6) Total hours -searched in daylight
- (7) Total area searched in daylight
- (8) Total colonies searched in daylight
- (9) Total ferret sign observed and location of sign seen during daylight search
- (10) Narrative describing search technique(s) used
- (11) Mapped location of central project

Surveyor Qualifications

The FWS has established a mechanism to provide specific training for conducting ferret surveys. This formal training (a 1-day workshop for biologists) is currently available through the Wyoming Cooperative Fishery and Wildlife Unit, Box 3166, University Station, Laramie, Wyoming 82071. All surveys should be conducted under the supervision of a trained survey crew supervisor.

FWS and Biota Research and Consulting of Jackson, Wyoming, have collaborated findings from Meeteetse, Wyoming, ferret studies and prepared a field guide, Handbook of Methods for Locating Black-footed Ferrets. This document is published by the Bureau of Land Management and provides detailed methods for locating ferrets and interpreting sign made by ferrets under field conditions. This handbook will be useful when designing surveys for ferrets whether for Section 7 compliance or for locating ferrets for conservation and recovery purposes. A copy of this document may be obtained upon request from:

1. Bureau of Land Management
Wyoming State Office
P.O. Box 1828
Cheyenne, Wyoming 82001
2. Biota Research and Consulting
Box 2705
Jackson, Wyoming 83001
3. Wyoming Game and Fish Department
5400 Bishop Boulevard
Cheyenne, Wyoming 82001
4. U.S. Fish and Wildlife Service
Endangered Species Office
P.O. Box 25486, DFC
Denver, Colorado 80225

COORDINATION OF SURVEYS

This section discusses **coordination** measures that **FWS believes** are vital to completing a survey.

State Wildlife Agency

The appropriate State wildlife agency should be contacted prior to initiating ferret surveys. They may **provide** historical information or literature pertinent to the survey or offer **suggestions** regarding access or landowner contacts needed for the survey. In **addition**, some States may require special permits for spotlighting **wildlife**.

Other Local Authorities

We **recommend** that survey planners contact local **authorities** and conservation officers (game wardens) before initiating surveys. **Many sheriffs'** departments cooperate with State conservation officers **in investigating** possible game violations. Spotlighting crews are often reported to the game warden and **sheriff** by local citizens and ranchers, and proper **coordination** of survey **activities** should prevent unnecessary conflict with these groups and agencies.

PROCEDURES TO FOLLOW IF FERRET SIGN OR A FERRET IS LOCATED

Sane **wildlife agencies** of States located **within** the potential range of the black-footed ferret have developed a procedure to follow when ferrets are seen and **reported**. A modified copy of the Montana procedure **is appended** (Appendix I). We **recommend** that agencies or their representatives request State procedures and review them prior to conducting surveys. If you observe a **ferret while** conducting surveys, you should notify the closest Field or Regional Office of the **FWS** or the respective State Game and Fish Office as soon as **possible**. A list of agencies and contacts **is** attached for reference (Appendix II).

Experience has shown that premature release of a ferret **sighting** to the **news** media can **have** lasting negative effects upon recovery actions in the area. We therefore request that contacts with news media be avoided until the presence of a ferret is confirmed by the State **wildlife** agency or FWS and necessary landowner contacts and **discussions** are completed.

Literature Cited

Stromberg, H. R. , R. L. Rayborn and T. U. Clark 1983 Black-footed ferret prey requirements: An energy balance J.Wildlife Manage. 47(1) p67-73.

APPENDIX I

PROCEDURE TO FOLLOW WHEN FERRET REPORTS AND/OR VERIFIED SIGHTINGS ARE RECEIVED (Montana Department of Fish, Wildlife and Parks)

The following procedure is **recommended** to **establish** a chain of action that has been agreed upon so each party's responsibility is defined. This should result **in** a speedy and smooth course of action when **sightings** are reported.

1. The (lead or your agency) will act as a central clearinghouse for all ferret **reports/sightings** and **will** initiate **this** reaction response procedure when ferret report/sightings have been made.
2. All ferret reports/sightings should be transferred to the (lead or your agency) within 8 hours of **receipt**. These reports should be given ~~to~~ **the following** people in order **of priority**:

Name

Office Number

Hunt Number

During non-office hours, these individuals should be contacted at their residences.

3. To expedite transfer of report **information** within each agency, it is recommended. that the first **individual obtaining the** Information contact **the** (lead or your agency) directly.
4. Information to be obtained and reported should include the following:
 - a. Name, address and telephone number of the observer (and person reporting);
 - b. Canplttt description and mapped location of observation as well as geographical location (township, range, **section**);
 - c. Date and **time** of observation;
 - d. Number of **animals** observed;
 - i. **Distance** to animal(s) observed **in** feet;
 - Length of **time** observed;
 - g. Activity of animal(s);
 - h. Proximity of nearest **prairie dog community**; and
 - i. Circumstance of observation.

5. The following individual(s) **will** evaluate the validity of the report: _____ and the report **will** be scored based on the following criteria: _____
- a. Observer reliability. High = 10 pts., Moderate = 5 pts., and Unknown or Questionable = 0 pts.;
 - b. Location. On a prairie dog town with other p.d. towns within 5 mi. = 10 pts., on or near p.d. town and few other towns within 5 mi. = 5 pts., no p.d. towns in vicinity = 0 pts.;
 - c. Distance of observation. Within 50 yards or up to 200 yds through 4+ power telescope = 10 pts., within 50-100 yds or 200 to 400 yds. through 4+ power scope = 5 pts., over 100 yds or 400+ yds. through 4+ power scope = 0 pts.;
 - d. Length of time observed. 5 or more min. - 10 pts., 30 seconds to 5 min. = 5 pts., less than 30 seconds = 0 pts.; and
 - e. Description of animal. Hark = 2 pts., Sire = 2 pts., Tail length Or color = 2 pts., Body color = 2 pts., and Leg color = 2 pts.

The following categories would be determined based upon the above scoring system:

- a. Highly probable. 40-50 pts. with no zeros on any criteria.
Action: Followup recommended without delay;
 - b. Likely. 30-40 pts. with no zeros or 40-50 pts with one zero.
Action: Followup within two days;
 - c. Fair. 22-30 pts. with no zeros or 30-40 pts. with one zero.
Action: Followup if convenient or if other reports have come from same vicinity; and
 - d. Unlikely. All other point categories.
Action: No action recommended.
7. If a followup is planned, the FWS and (lead or your agency) will be notified immediately and a decision made as to which of the agencies should begin the followup procedure. If no followup is planned, the information will be forwarded to the above parties by mail.
8. A followup search in response to a report will be as follows:
- a. One to three (maximum) of the involved researchers will contact private landowners in the vicinity of the search and inform them of the desire to followup and solicit their support;
 - b. Up to four field biologists will begin prearranged surveys; and
 - c. The length of time spent in the area surveying will be dependent upon the judgment of the field researchers.

9. When a ferret sighting has been made, immediate confidentiality will be maintained, and the following action will be taken:
- a. The FWS will be notified, consulted, and impending procedure will be agreed upon; and
 - b. The landowner/lessee or public agency landowner will be contacted by (lead or your agency) within 48 hours, if possible, to work out details of the followup effort.

APPENDIX II

Lists

1. U.S. Fish and **Wildlife** Field Office contacts should be made with the **appropriate Field Supervisor** or **Regional Director**, attention **the following** Individuals when **possible**:

Wayne Brewster
Ronald Crete
301 South Park
P.O. Box 10023
Helena, MT 59626
Telephone FTS 585-5225
or (406) 449-5225
(MT, WY)

Wally Jobman
Office of Endangered **Species**
U.S. Fish and **Wildlife** Service
Room 430
1811 West 2nd Street
Grand Island, NE 68801
Telephone FTS 541-6571
or (308) 381-5571
(ND, SD, KS, NE)

James Johnson
Office of Endangered Species
U.S. **Fish and Wildlife Service**
500 Gold Avenue **S.W.**
Albuquerque, NH 87102
Telephone FTS 474-3972
or (505) 766-3972
(AZ, **NM**, TX, OK)

Robert **Ruesink**
Field Supervisor
2078 **Administration Building**
1745 **W. 1700 S.**
Salt Lake City, UT 84104-5110
Telephone FTS 588-4430
or (801) 524-4430
(UT)

Bob Leachman
Office of Endangered Species
U.S. **Fish and Wildlife Service**
529 **25 1/2** Road
Grand Junction, CO 81505
Telephone FTS 322-0348
or (303) 241-0563
(CO)

Max Schroeder
Office of Endangered Species
U.S. Fish and **Wildlife Service**
134 Union Blvd.
Lakewood, CO 80228
Telephone **FTS 776-7398**
or (303) 236-7398
(MT, **WY**, UT, ND, SD, KS, NE)

2. State contacts should be made **with** the appropriate State **Director**, attention **the following** individuals:

Colorado

Judy **Shepherd**
Nongame Biologist
6060 Broadway
Denver, CO 80216
Telephone (303) 297-1192

Montana

John D. **Cada**
Fish & Wildlife Biologist Supervisor
80x 5, **MSU Campus**
Bozeman, MT 59717-0001
Telephone (406) 994-6363

Kansas

Marvin Schwilling, Project Leader
Nongame and Endangered Wildlife
Kansas Fish and Game Commission
Res. Office
832 E. 6th St.
Emporia, KS 66801
Telephone (316) 342-0658

Montana

Dennis L. Flath
Nongame Biologist
80x 5. MSU Campus
Bozeman, MT 59717-0001
Telephone (406) 994-6354

North Dakota

Stan Kohn
Nongame Management Biologist
North Dakota Game and
Fish Department
2121 Lovett Avenue
Bismark, ND 58505
Telephone (701) 221-6300

South Dakota

George Vandell
South Dakota Game, Fish and
Parks Department
Sfgurd Anderson Building
Pierre, SD 57501
Telephone (605) 773-3387

Utah

Robert Hasenyager
Utah Division of Wildlife
Resources
1596 West North Temple
Salt Lake City, UT 84116
Telephone (801) 533-9333

Nebraska

Ross Lock
Nebraska Game and Parks
Commission
P. O. 80x 30370
Lincoln, NE 68503
Telephone (402) 464-0641

New Mexico

Dr. John Hubbard
George Schmitt
New Mexico Department of
Game and Fish
Villagra Building
Santa Fe, NM 87503
Telephone (505) 827-7899

Wyoming

Harry Harju
Supervisor of Biological Services
Wyoming Game and Fish Department
5400 Bishop Blvd.
Cheyenne, WY 82002
Telephone (307) 777-7631

Dave Belitsky
Black-footed Ferret Program
Coordinator
Wyoming Game and Fish Department
2820 State Highway 120
Cody, WY 82414
Telephone (307) 527-7125

APPENDIX II.

**FEDERAL REGISTER: ENVIRONMENTAL PROTECTION AGENCY INTENT TO
CANCEL STRYCHNINE RESTRICTION**

Federal Register

Wednesday
March 4, 1987

Part VIII

**Environmental
Protection Agency**

**Strychnine; Intent To Cancel; Partial
Withdrawal of Prior Cancellation Notice**

ENVIRONMENTAL PROTECTION A G E N C Y

(OPP-30000/TF; FRL 3164-5)

Strychnine; Intent To Cancel; Partial Withdrawal of Prior Cancellation Notice

AGENCY: Environmental Protection
Agency.

ACTION: Notice.

SUMMARY: On October 19, 1983, EPA concluded its special review of pesticide products containing strychnine and issued a notice of intent to cancel registration of and deny application for strychnine-containing pesticides used for control of certain rodents on rangeland, pasture, cropland, and non-agricultural sites and required modification of the terms and conditions of registrations for strychnine-containing pesticides for control of certain rodents and birds on those sites. 48 FR 48522. A hearing was requested to determine whether registrations for strychnine-containing pesticides should be canceled for control of prairie dogs and meadow mice and whether the modification of terms and conditions of registration for strychnine-containing pesticides for control of prairie dogs should be required. Prior to the evidentiary phase of the hearing, the parties engaged in extensive settlement negotiations. As a result of information presented and commitments made by the parties to the resulting settlement agreement, EPA has determined that unconditional cancellation of strychnine registrations for prairie dog and meadow mouse control is no longer necessary to prevent unreasonable adverse effects on the environment. This notice withdraws the original notice of intent to cancel as it pertains to product registrations for control of prairie dogs, meadow mice, and ground squirrels and issues a notice of intent to cancel registrations and deny applications for strychnine-containing pesticides for prairie dog, ground squirrel, and meadow mouse control unless modification of the terms and conditions of registration are made in accordance with this Notice.

DATES: A request for a hearing by a registrant or an applicant must be received on or before April 3, 1987 or within 30 days from receipt by mail of this Notice, whichever date is later. A request for a hearing submitted by any other adversely affected person must be received on or before April 3, 1987.

ADDRESS: Requests for a hearing must be submitted to: Hearing Clerk (A-100).

Environmental Protection Agency, 401 M St., SW, Washington, DC 20460.

FOR FURTHER INFORMATION CONTACT: By mail: Walter Waldrop, Registration Division (TS-767C), Office of Pesticide Programs, Environmental Protection Agency, 401 M St., SW, Washington DC 20460.

Office location and telephone number: Rm. 1016, Crystal Mall Building #2, 1921 Jefferson Davis Highway, Arlington, VA, (793) 557-5493.

SUPPLEMENTARY INFORMATION:

I. Introduction

EPA issued a Notice of Rebuttable Presumption Against Registration for certain pesticides containing strychnine, published in the Federal Register of January 13, 1977 (42 FR 2713). This notice identified possible risks associated with the outdoor, above-ground uses of strychnine-containing pesticides and solicited public comment relevant to the risks and benefits of these uses. On November 5, 1980, after evaluation of comments, EPA published a Position Document (PD 2/3) which proposed to cancel registrations of and deny applications for certain uses of strychnine-containing pesticides and conditionally cancel other uses unless terms and conditions of registration were modified. This proposed decision was submitted for review and comment to the Scientific Advisory Panel (SAP) and the Secretary of Agriculture. In addition, EPA solicited further comments from the public on its proposed decision. After evaluation of the comments received, EPA published a Notice of Intent to Cancel registrations of and deny applications for strychnine-containing pesticides for certain uses and require modification of terms and conditions of registrations for strychnine-containing pesticides for other uses, in the Federal Register of October 19, 1983 (48 FR 48522). The Agency received requests to hold a hearing to determine whether strychnine registrations for the control of prairie dogs and meadow mice should be canceled and whether strychnine registrations for control of ground squirrels should be canceled unless certain terms and conditions of registration were modified. Except for those uses for which a hearing was requested, all strychnine registrations for outdoor, above-ground uses have now been canceled by operation of law or have had the terms and conditions of registration modified as proposed in the October 19, 1983 Notice of Intent to Cancel.

A pre-hearing conference was held in which it was determined that the

following would be the only active parties during the strychnine cancellation hearing: (1) The U.S. Environmental Protection Agency, (2) the State of Wyoming, (3) the State of South Dakota, (4) the American Farm Bureau Federation, (5) the Sierra Club, (6) the Defenders of Wildlife, (7) the U.S. Department of the Interior, and (8) the U.S. Department of Agriculture. Subsequent to the pre-hearing conference and prior to the taking of testimony, the active parties obtained stays of the proceedings in order to attempt to reach a negotiated settlement. It was during the course of these negotiation meetings that EPA was persuaded that safeguards could be employed in strychnine application that would reduce the environmental risk to the extent that it would be outweighed by the benefits of use. With the exception of Sierra Club and Defenders of Wildlife, all the active parties have agreed to a settlement.

The Administrator has determined that the use of strychnine-containing pesticides for the control of prairie dogs, ground squirrels, and meadow mice will not pose unreasonable adverse environmental effects, if the terms and conditions of registration are modified as set forth by the Settlement Agreement, as amended. This Notice announces EPA's decision to withdraw that portion of the original notice of intent to cancel which pertained to registrations of strychnine products for prairie dog, meadow mouse, and ground squirrel control, and to issue a new notice of intent to cancel registrations for those uses unless the terms and conditions of the pertinent strychnine registration are modified to include the necessary safeguards agreed to in the settlement. The portion of the original cancellation notice pertaining to strychnine registrations for control of other pests is unaffected by this Notice.

If the terms and conditions of registration are not modified as required by this Notice, the Administrator has determined that the use of strychnine-containing pesticides for the control of prairie dogs, ground squirrels, and meadow mice will cause unreasonable adverse environmental effects. Failure to modify the terms and conditions of registration as required by this Notice is grounds for cancellation.

This Notice is organized into nine units. Unit I is this introduction. Unit II, entitled, "Legal Background" provides a general discussion of the regulatory framework within which this action is taken. Unit III summarizes the risks and benefits associated with the relevant uses of strychnine. Unit IV discusses the

regulatory options. Unit V **presents** the regulatory decision. The strychnine Settlement Agreement, as amended appears in Unit VI. Unit VII describes the label modifications required by this Notice. Unit VIII contains comments Of the Scientific Advisory Panel and the U.S. Department of Agriculture along with the Agency's **responses** to these comments. Unit IX, entitled "Procedural Matters," provides a brief discussion of the procedures which will be followed in implementing the regulatory action which the Agency is **announcing** in this Notice.

II. Legal Background

In order to obtain a registration for a pesticide under the Federal Insecticide, Fungicide, and Rodenticide Act, (FIFRA), as amended, an applicant for registration must demonstrate that the pesticide satisfies the statutory standard for registration. The standard for registration under FIFRA section 3(c)(5) requires, among other things, that the pesticide perform its intended function without causing "unreasonable adverse effects on the environment." The term "unreasonable adverse effects on the environment" is defined under FIFRA section 2(bb) 83 "any unreasonable risk to man or the environment, taking into account the economic, social, and environmental costs and benefits of the use of any pesticide." This standard requires a finding that the benefits of the use of the pesticide exceed the risks of use, when the pesticide is used in compliance with the terms and conditions of registration or in accordance with commonly recognized practices.

In determining whether the use of a pesticide poses risks which are greater than the benefits, the Agency considers possible changes to the terms and conditions of registration which can reduce risks, and the impact of such modifications on the benefits of use. If the Agency determines that such changes reduce risk to the level when the benefits outweigh the risks, it may require that such changes be made in the terms and conditions of the registrations. Alternatively, the Agency may determine that no changes in the terms and conditions of a registration will adequately assure that use of the pesticide will not pose any unreasonable adverse effects. If the Agency makes such a determination, it may seek cancellation, and if necessary, suspension. In either case, the Agency may issue a Notice of Intent to Cancel the registrations. If the Notice requires changes in the terms and conditions of registration, Cancellation may be avoided by making the specified

corrections set forth in the Notice. Adversely affected persons may also request a hearing on the cancellation of a specified registration and use if they do so in a legally effective manner. That registration and use will be maintained pending a decision at the close of an administrative hearing.

III. Summary of Risks and Benefits Determination

A. Risk Determination

In the Strychnine cancellation notice, EPA referred to Position Documents 2/3 and 4 (PD #2/3, PD #4), in which the Agency set forth in detail its assessment of the risks and benefits associated with the outdoor, above-ground use of strychnine. Generally, the Agency determined that, in light of modest benefits, certain of these uses of strychnine caused unreasonable adverse effects on the environment because of the risks they pose to nontarget species. Specifically, the Agency determined that strychnine used to control prairie dogs and ground squirrels would jeopardize the continued existence of the black-footed ferret, an endangered species.

The Agency identified strychnine as highly toxic to all carnivores upon which it had been tested and determined that it was prudent to assume that strychnine would be highly toxic to black-footed ferrets as well. The Agency also determined that black-footed ferrets were likely to feed on prairie dog and ground squirrel carcasses that had been poisoned with strychnine and that under certain field conditions they would die from secondary poisoning. Furthermore, the Agency was informed by the U.S. Office of Endangered Species (OES) in a "jeopardy opinion" that conducting a pre-control black-footed ferret survey to determine the presence of black-footed ferrets was not a sufficient safeguard to permit strychnine treatment in its habitat. During the course of the settlement negotiations, however, OES reconsidered its original "jeopardy opinion." Based upon further experience with black-footed ferret survey technique and their reliability in locating ferrets in the Meeteetse Wyoming black-footed ferret population, OES determined that, if no ferrets were found in a pre-control black-footed ferret survey conducted according to OES survey guidelines and the requirements of this Notice, strychnine could be used to control prairie dogs and ground squirrels without jeopardizing the continued existence of the black-footed ferret. Furthermore, the States of Wyoming and South Dakota agreed to establish programs whereby those states would control strychnine

distribution for prairie dog control and help monitor the conduct of the pre-control black-footed ferret surveys. EPA has, therefore, been persuaded that if the terms and conditions of strychnine registration are modified in accordance with this Notice that the risk to the black-footed ferret from secondary poisoning will be greatly reduced.

B. Benefits Determination

As discussed in detail in PD's #2/3 and #4, EPA has determined that the impact of cancellation of strychnine registrations for pesticides used for prairie dogs would be minor. Under the worst case assumption, for example, EPA estimated that there would be slightly more than a \$1 million dollar annual increase nationwide in application cost if strychnine registration for prairie dog control were to be cancelled. The economic impact of cancellation of registrations for meadow mouse control and for restricted ground squirrel control was determined to be 30 slight as to be negligible. EPA has not been persuaded that its original evaluation of economic impact of Cancellation of and restrictions on registrations for prairie dog, meadow mouse, and ground squirrel was in error.

IV. Regulatory Options

EPA has determined that unrestricted use of strychnine-containing pesticides for control of prairie dogs and ground squirrels poses a risk of secondary poisoning to the black-footed ferret. However, this risk may be greatly reduced if the terms and conditions of registration for strychnine-containing pesticide are modified in accordance with this Notice.

In reaching the decision to allow continued registration for strychnine-containing pesticides for control of prairie dogs, ground squirrels, and meadow mice, the Agency considered the following regulatory options:

1. Continuation of the registrations for prairie dogs, ground squirrels, and meadow mice without additional restrictions.

2. Continuation of the registrations for prairie dogs, ground squirrels, and meadow mice with modifications of the terms and conditions of registration.

3. Cancellation of registrations of and denial of application for all strychnine-containing pesticides for control of prairie dogs, ground squirrels, and meadow mice.

In considering option 1, EPA concluded that strychnine-containing pesticides used according to current labels for control of prairie dogs and ground squirrels would present

unreasonable adverse environmental effects. As discussed in PD's #2/3 and #4, the minor benefits of use do not outweigh the risk to the black-footed ferret, an endangered species, from secondary poisoning.

In considering option 3, EPA has now determined that cancellation of strychnine registration for control of prairie dogs, ground squirrels and meadow mice is no longer necessary. Based upon the representations made by the U.S. office of Endangered Species (OES) and the States of Wyoming and South Dakota during the settlement negotiations, EPA has determined that a pre-control black-footed ferret survey in accordance with OES survey guidelines and the requirements of this Notice and a state program under which the state would be the only distributor of strychnine-containing pesticides for prairie dog control would sufficiently safeguard the continued existence of the black-footed ferret. Furthermore, EPA has determined as it had under the previous notice, that the risk to the black-footed ferret from use of strychnine-containing pesticide for control of ground squirrels is sufficiently low if application is restricted in accordance with this Notice. The most important ground squirrel application restriction creates a buffer zone around a prairie dog colony within which strychnine-containing pesticides could not be used for ground squirrel control.

EPA has, therefore, decided to adopt option 2. Despite relatively low benefits associated with the use of strychnine-containing pesticides for prairie dog, ground squirrel, and meadow mouse control, they outweigh the even lower risk to the black-footed ferret from secondary poisoning if the terms and conditions of registration are modified in accordance with this Notice.

V. Regulatory Decision

The Administrator has decided to partially withdraw the Notice of Intent to Cancel Certain Strychnine Registrations of October 19, 1983 (48 FR 48522) and to issue a new notice.

The Administrator has further determined that the use of strychnine-containing pesticides for prairie dog, ground squirrel, and meadow mouse control will cause unreasonable adverse effects to the environment unless the terms and conditions of registrations are modified as described below and in accordance with the Settlement Agreement (Unit VI).

VI. Settlement Agreement, as Amended

The text of the settlement agreement, as amended, is set forth below:

I. Introduction

The undersigned parties (hereinafter "parties") have negotiated the following settlement agreement. The purpose of this settlement agreement is to allow the continued registration of use of strychnine to control prairie dogs, ground squirrels, and meadow mice under conditions which will avoid jeopardizing the black-footed ferret, an endangered species, and which will reduce the risk of adverse effects on other nontarget species. To achieve this goal, the parties agree that strychnine registration for control of prairie dogs will include (1) the establishment of a state program for exclusive distribution and monitoring of strychnine for use on prairie dogs, (2) compliance with Black-Footed Ferret Survey Guidelines developed by the U.S. Fish & Wildlife Service, and (3) certain label statements. Certain label statements will also be added to the labels of products intended for ground squirrel and meadow mouse control.

II. State Program

The parties agree that states desiring to use strychnine to control prairie dogs must establish an exclusive program of strychnine distribution, monitoring, and record maintenance. Each state may designate an appropriate agency to conduct its strychnine program. For example, the State of Wyoming will utilize the Weed and Pest Control Districts at the county level to administer the program. The State of South Dakota will establish a state-level program administered through its Department of Agriculture. In order to procure strychnines for prairie dog control, the land on which strychnine is to be applied must be cleared for application in accordance with procedures set forth in the FWS Black-Footed Ferret Survey Guidelines, including a report of a survey where required under the Guidelines.

If any survey required by the Guidelines has discovered one or more black-footed ferrets, the agency responsible for conducting the survey will refer the survey report and any physical evidence of the presence of black-footed ferrets to the appropriate regional office of the U.S. Fish and Wildlife Service (FWS) for further review and examination by the FWS Regional Office Endangered Species Staff Specialist. Based upon the survey report and analysis of any physical evidence, and further investigation where deemed appropriate, FWS will make a finding concerning the presence or absence of black-footed ferrets in the proposed treatment area. Based on its findings it will recommend whether: (1) The requested use of strychnine should be permitted according to the terms and conditions of registration and, if necessary, any other conditions relating to black-footed ferrets, deemed necessary under the Endangered Species Act indicated by FWS, (2) the requested use should be prohibited for the treatment area and/or any other area where ferret presence is verified by FWS, (3) another black-footed ferret survey should be completed before a final decision regarding use is made. The recommendations of the FWS will be binding on the states and users pursuant to the terms

of this settlement and the applicable provisions of FIFRA.

If the survey has not discovered any black-footed ferret or evidence indicating the presence of a black-footed ferret, or if FWS fails to respond to a referral which does not include submission of any physical evidence within two weeks, the agency responsible for administering the program may determine whether or not to permit the requested use of strychnine. FWS may impose additional restrictions not inconsistent with the label. If the referral to FWS includes physical evidence which will require laboratory analysis, FWS will contact the responsible agency within the two week period set forth herein and indicate a time certain in which it will respond to the referral.

If strychnine treatment for control of prairie dogs is proposed for a treatment area which includes more than one State, the requirements for and of each State program will apply, except that only one black-footed ferret survey need be conducted, and, where required, one referral need be submitted to FWS.

The State program will monitor the use of strychnine for control of prairie dogs to verify that such use is in accordance with the terms and conditions of registration and this negotiated settlement. In addition, the State program must maintain records of the prairie dog strychnine treatment requests, the black-footed ferret surveys, and the eventual disposition of the prairie dog strychnine treatment requests.

III. The Black-Footed Ferret Survey

The parties agree that any black-footed ferret survey required hereunder will be conducted in accordance with the guidelines applicable to "prairie dog control projects" in the "Draft Black-Footed Ferret Survey Guidelines for Compliance with the Endangered Species Act" of January 20, 1986 as published by the U.S. Fish and Wildlife Service (Survey Guidelines), and its subsequent editions, if any, and the specific terms and conditions of this negotiated settlement. To the extent that the present or future Survey Guidelines differ from or are incompatible with the terms and conditions of this settlement document, the terms and conditions of the survey guidelines will control.

The Survey Guidelines, as drafted, were developed solely to apply to Federal agency actions which might affect the black-footed ferret. For the purposes of this negotiated settlement, the Survey Guidelines will apply to all strychnine treatment to control prairie dogs, regardless of the identity of those proposing treatment, and all recommendations or suggestions pertaining to surveys in the FWS Survey Guidelines are made mandatory with respect to the use of strychnine for prairie dog control.

The parties agree that strychnine cannot be used to control prairie dogs unless FWS or the appropriate state agency has determined, in accordance with section II above, that no black-footed ferrets are likely to be present.

The parties responsible for conducting surveys will make every effort to perform surveys as expeditiously as possible so as

not to unduly delay proposed strychnine treatment.

The parties agree that all black-footed ferret surveys must be supervised on site by either a U.S. Department of Agriculture (USDA) animal damage control employee... or an FWS employee, or an employee of a state wildlife or animal damage control agency who has satisfactorily completed the black-footed ferret survey training program approved by the FWS.¹

IV. Label Statements

All current strychnine registrations for prairie dog control must also include the following label statements:

(1) Do not expose baits in a manner which presents a likely hazard to pets, poultry or livestock.

(2) Do not place bait in piles.

(3) Where feasible, pick up and burn or bury all visible carcasses of animals in or near treated areas.

(4) Do not use for prairie dog control in areas occupied by the Utah prairie dog in Garfield, Iron, Kane, Piute, Sevier and Wayne Counties, Utah or in Wyoming on that area identified by the Wyoming Game and Fish Department as the Meeteetse black-footed ferret colony.

(5) The killing of an endangered species during strychnine baiting operations may result in a fine and/or imprisonment under the Endangered Species Act. Strychnine baits should not be used in the geographic ranges of the following species except under programs and procedures approved by the USEPA: Gray wolf and Grizzly Bear.

(6) All strychnine baits for control of prairie dogs must be dyed yellow.

(7) Sale, distribution and use of this product must be in accordance with the provisions of the Administrator's final order.

Current strychnine registrations for ground squirrel control must include the following label statements:²

(1) Do not expose baits in a manner which presents a likely hazard to pets, poultry or livestock.

(2) Do not place bait in piles.

(3) Where feasible, pick up and burn or bury all visible carcasses of animals in or near treated areas.

(4) Do not use for ground squirrel control in areas occupied by the Utah prairie dog in Garfield, Iron, Kane, Piute, Sevier and Wayne Counties, Utah.

(5) Do not use for ground squirrel control within 200 yards of the boundaries of prairie dog colonies.

(6) Do not use within one mile of the boundary of prairie dog colony where the presence of a black-footed ferret has been confirmed.

¹ For the purposes of this settlement only, an "employee" of the USDA animal damage control program, FWS or a state may include any person employed on a permanent, temporary, or contract basis. Such persons cannot have a financial interest with respect to the property or the control of prairie dogs or the property to be surveyed.

² The American Farm Bureau Federation states that its participation in this proceeding is limited to issues involving the use of strychnine for prairie dog control. Consequently, it takes no position on the portions of this settlement pertaining to products for ground squirrel and meadow mouse control.

by the U.S. Fish and Wildlife Service Office of Endangered Species or comparable State agency.

(7) The killing of an endangered species during strychnine baiting operations may result in a fine and/or imprisonment under the Endangered Species Act. Before baiting, the user is advised to contact the regional U.S. Fish and Wildlife Service (Endangered Species Specialist) or the local Fish and Game Office for specific information on endangered species. Strychnine baits should not be used in the geographic ranges of the following species except under programs and procedures approved by the USEPA: California Condor, San Joaquin Kit Fox, Aleutian Canada Goose, Morro Bay Kangaroo Rat, Gray Wolf, and Grizzly Bear.

(8) All strychnine baits for control of ground squirrels must be dyed yellow.

(9) Sale, distribution and use of this product must be in accordance with the provisions of the Administrator's final order.

Current strychnine registrations for meadow mouse control must include the following label statements:³

(1) Do not expose baits in a manner which presents a likely hazard to pets, poultry, or livestock.

(2) Do not place bait in piles.

(3) Where feasible, pick up and burn or bury all visible carcasses of animals found in or near treated areas.

(4) Do not use for meadow mouse control in areas occupied by the Mississippi sandhill crane in Jackson County, Mississippi.

(5) Do not use for meadow mouse control in areas occupied by the Cape Sable sparrow in Collier, Dade and Monroe Counties, Florida.

(6) Do not use for meadow mouse control in areas occupied by the masked bobwhite quail in Pima and Santa Cruz Counties, Arizona.

(7) Do not use for meadow mouse control in areas occupied by the Utah prairie dog in Garfield, Iron, Kane, Piute, Sevier, and Wayne Counties, Utah.

(8) Do not use for meadow mouse control in areas occupied by Attwater's greater prairie chicken in the following Texas counties: Aransas, Austin, Brazoria, Colorado, Fort Bend, Galveston, Goliad, Refugio, and Victoria.

(9) The killing of an endangered species during strychnine baiting operations may result in a fine and/or imprisonment under the Endangered Species Act. Before baiting, the user is advised to contact the Regional U.S. Fish and Wildlife Service (Endangered Species Specialist) or the local state agency responsible for wildlife for specific information on endangered species. Strychnine baits should not be used in the geographic ranges of the following species except under programs and procedures approved by the USEPA: California Condor, San Joaquin Kit Fox, Aleutian Canadian Goose, Morro Bay Kangaroo Rat, Gray Wolf, and Grizzly Bear.

(10) All strychnine baits for control of meadow mice will be dyed yellow.

³ The State of South Dakota states that its participation in this proceeding is limited to issues involving the use of strychnine for prairie dog and ground squirrel control. Consequently, it takes no position on the portions of this settlement pertaining to products for meadow mouse control.

(11) Sale, distribution and use of this product must be in accordance with the provisions of the Administrator's final order.

v. Implementation and Modification of the Terms and Conditions of the Negotiated Settlement

The parties to the Settlement understand that this Settlement will be implemented through the following procedures. Based on this agreement, which will be filed in the record of FIFRA Docket No. 518, *et al.*, EPA will withdraw the relevant portions of the Notice of Intent to Cancel which initiated that proceeding. EPA will then expeditiously issue a new Notice of Intent to Cancel the registration of certain strychnine products; this new notice will be consistent with the terms and conditions of this Settlement Agreement. The undersigned parties do not to request a hearing to contest this new notice, insofar as it conforms to terms of this Settlement.

The parties further agree that upon agreement of all the undersigned parties the terms and conditions of this negotiated Settlement can be modified. In addition, the terms and conditions of any strychnine registration can be modified by Agency action pursuant to the Federal Insecticide, Fungicide, and Rodenticide Act, as amended, and its accompanying regulations.

Settlement Agreement and Amendment to Settlement Agreement signed by:

Kevin Lee,

Counsel for U.S. Environmental Protection Agency.

David Fisher,

Counsel for U.S. Fish and Wildlife Service.

Margaret M. Breinholt,

Counsel for the U.S. Department of Agriculture.

Richard L. Krause,

Counsel for American Farm Bureau Federation, South Dakota Farm Bureau Federation, Wyoming Farm Bureau Federation.

Weldon S. Caldeback,

Senior Assistant Attorney General, State of Wyoming.

Roxanne Giedd,

Assistant Attorney General, Counsel for State of South Dakota Department of Agriculture.

Ida Sebesta,

Sebesta Bait Mixing Plant.

VII. Label Modification

This Notice requires that the strychnine Settlement, as amended (Unit VI), become part of the terms and condition of strychnine registration for prairie dog, ground squirrel, and meadow mouse control and that labels be modified as follows:

A. All Labels

Attention Strychnine Applicators

(1) Use of strychnine to control any prairie dog is prohibited within 200 yards of any prairie dog colony not exempted from precontrol black-footed ferret survey requirements by the US.

Fish and Wildlife Service Guidelines unless strychnine is used in accordance with all label requirements pertaining to prairie dog control. Consult with state distribution agent regarding qualifications for exemptions.

(2) Use of strychnine by any method of application not specified by the label is prohibited.

B. Labels for Prairie Dog Control

All current strychnine registrations for prairie dog control must include the following label statements:

Attention Strychnine Applicators

(1) Use of strychnine for control of prairie dogs is prohibited unless distribution and treatment is done in accordance with the 1986 strychnine Settlement. The amended Terms of the Strychnine Settlement include (i) the establishment of a state program for exclusive state distribution and monitoring of strychnine for use on prairie dogs, (ii) compliance with the Black-Footed Ferret Guidelines developed by the U.S. Fish & Wildlife Service (FWS), and (iii) certain label statements found on this label. Consult with state distribution agent regarding the detailed requirements of the 1986 Strychnine Settlement.

(2) Do not expose baits in a manner which presents a likely hazard to pets, poultry or livestock.

(3) Do not place bait in piles.

(4) Where feasible, pick up and burn or bury all visible carcasses of animals in or near treated areas.

(5) Do not use for prairie dog control in areas occupied by the Utah prairie dog in Garfield, Iron, Kane, Piute, Sevier and Wayne Counties, Utah or in Wyoming on that area identified by the Wyoming Game and Fish Department or the Montana black-footed ferret survey.

(6) The killing of an endangered species during strychnine baiting operations may result in a fine and/or imprisonment under the Endangered Species Act. Strychnine baits should not be used in the geographic ranges of the following species except under programs and procedures approved by the USEPA: Gray Wolf and Grizzly Bear.

(7) All strychnine baits for control of prairie dogs must be dyed yellow.

(8) Sale, distribution and use of this product must be in accordance with the provisions of the Administrator's final order.

State Requirements

(1) The use of strychnine to control prairie dogs is permitted only in States which establish an exclusive program of strychnine distribution, monitoring, and record maintenance. Each State may designate an agency to conduct its strychnine program. In order to procure strychnine for prairie dog control, the land on which strychnine is to be applied must be cleared for application in accordance with procedures set forth in the FWS Black-Footed Ferret Survey Guidelines, including a report of survey where required under the Guidelines.

If any survey required by the Guidelines has discovered evidence of one or more black-footed ferrets, the agency responsible

for conducting the survey will refer the survey report and any physical evidence of the presence of black-footed ferrets to the appropriate regional office of FWS for further review and examination by the FWS Regional Office Endangered Species Staff Specialist. Based upon the survey report and analysis of any physical evidence, and further investigation where deemed appropriate, FWS will make a finding concerning the presence or absence of black-footed ferrets in the proposed treatment area. Based on its findings it will recommend whether: (i) The requested use of strychnine should be permitted according to the terms and conditions of registration and, if necessary, any other conditions relating to black-footed ferrets, deemed necessary under the Endangered Species Act indicated by FWS, (ii) The requested use should be prohibited for the treatment area and/or any other area where ferret presence is verified by FWS, (iii) Another black-footed ferret survey should be completed before a final decision regarding use is made. The recommendations of the FWS will be binding on the states and users.

If the survey has not discovered any black-footed ferret or evidence indicating the presence of a black-footed ferret, or if FWS fails to respond to a referral which does not include submission of any physical evidence within two weeks, the agency responsible for administering the program may determine whether or not to permit the requested use of strychnine, and may impose additional restrictions not inconsistent with the label. If the referral to FWS includes physical evidence which will require laboratory analysis, FWS will contact the responsible agency within the two week period set forth herein and indicate a time certain in which it will respond to the referral.

If strychnine treatment for control of prairie dogs is proposed for a treatment area which includes more than one State, the requirements for each State program will apply, except that only one black-footed ferret survey need be conducted and, where required, one referral need be submitted to FWS.

The state program must monitor the use of strychnine for control of prairie dogs to verify that such use is in accordance with the terms and conditions of registration and the strychnine settlement.

In addition, the State program must maintain records of the prairie dog strychnine treatment requests, the black-footed ferret surveys, and the eventual disposition of the prairie dog strychnine treatment requests. (2) The Black-Footed Ferret Survey: Any black-footed ferret survey required hereunder must be conducted in accordance with the guidelines applicable to "prairie dog control projects" in the "Draft Black-Footed Ferret Survey Guidelines for Compliance With the Endangered Species Act" of January 30, 1985 as published by the U.S. Fish and Wildlife Service (Survey Guidelines), and its subsequent editions, if any, and the specific terms and conditions of the strychnine settlement. To the extent that the present or future Survey Guidelines differ from or are incompatible with the terms and conditions of the strychnine settlement, the terms and

conditions of the survey guidelines will control.

Although the Survey Guidelines, as drafted, were developed solely to apply to Federal agency actions which might affect the black-footed ferret, the Survey Guidelines also apply to all strychnine treatments to control prairie dogs, regardless of the identity of those proposing treatment, and all recommendations or suggestions pertaining to surveys in the FWS Survey Guidelines are made mandatory with respect to the use of strychnine for prairie dog control.

Strychnine cannot be used to control prairie dogs unless FWS or the appropriate state agency has determined that no black-footed ferrets are likely to be present.

The parties responsible for conducting surveys will make every effort to perform surveys as expeditiously as possible so as not to unduly delay proposed strychnine treatment.

All black-footed ferret surveys must be supervised on site by either a U.S. Department of Agriculture (USDA) animal damage control employee, an FWS employee, or an employee of a state wildlife or animal damage control agency who has satisfactorily completed the black-footed ferret survey training program approved by FWS. An "employee" of the USDA animal damage control program, FWS, or a state may include any person employed on a permanent, temporary, or contract basis. Such persons cannot have a financial interest with respect to the property or the control of prairie dogs on the property to be surveyed.

C. Labels for Ground Squirrel Control

Current strychnine registrations for ground squirrel control must include the following label statements:

Attention Strychnine Applicators

(1) Do not expose baits in a manner which presents a likely hazard to pets, poultry or livestock.

(2) Do not place bait in piles.

(3) Where feasible, pick up and burn or bury all visible carcasses of animals in or near treated areas.

(4) Do not use for ground squirrel control in areas occupied by the Utah prairie dog in Garfield, Iron, Kane, Piute, Sevier and Wayne Counties, Utah.

(5) Do not use for ground squirrel control within 200 yards of the boundaries of prairie dog colonies.

(6) Do not use within one mile of the boundary of a prairie dog colony where the presence of a black-footed ferret is confirmed by the U.S. Fish and Wildlife Service Office of Endangered Species or a comparable State agency.

(7) The killing of an endangered species during strychnine baiting operations may result in a fine and/or imprisonment under the Endangered Species Act. Before baiting, the user is advised to contact the regional U.S. Fish and Wildlife Service (Endangered Species Specialist) or the local Fish and Wildlife Game Office for specific information on endangered species. Strychnine baits should not be used in the geographic ranges of the following species except under programs and

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B. Procedure for Requesting a Hearing

To contest the regulatory actions set forth by this Notice, registrants, and any applicant whose application for registration has been denied, may request a hearing within 30 days of receipt of this Notice, or within 30 days from the publication of this Notice in the Federal Register, whichever occurs later. Any other person adversely affected by the cancellation action described in this Notice, or my interested person with the concurrence of an applicant whose application for registration has been denied may request a hearing within 30 days of publication of this Notice in the Federal Register.

All registrants, applicants, and other adversely affected persons who request a hearing must identify the specific registration(s) by Registration Number(s) and the specific use(s) for which a hearing is requested, and must be received by the Hearing Clerk within the applicable 30-day period. Failure to comply with these requirements will result in denial of the request for a hearing. Requests for a hearing should also be accompanied by objections that are specific for each use of the pesticide product for which a hearing is requested.

Requests for a hearing must be submitted to: Hearing Clerk (A-100),

Environmental Protection Agency, 401 M St., SW, Washington, DC 20460.

1. Consequences of Filing a Timely and Effective Hearing Request

If a hearing on any action initiated by this Notice is requested in a timely and effective manner, the hearing will be governed by the Agency's Rules of Practice for Hearings under FIFRA section 6 (40 CFR Part 164). The registrations of products held by persons who request and are granted a hearing remain in effect during the hearing except pursuant to an order of the Administrator. Similarly, the denial of registration will not become effective except by order of the Administrator if the applicant requests and is granted a hearing on the denial.

The hearing will be limited to the specific registrations or applications for which the hearing is requested.

2. Consequences of Failure to File in a Timely and Effective Manner

If a hearing concerning the cancellation or denial of registration of a specific strychnine-containing pesticide subject to this Notice is not requested by the end of the applicable 30-day period, and the registrant has not amended his registration in accordance with this notice, registration of that pesticide will be cancelled, or the denial will be effective.

B. Separation of Functions

The Agency's Rules of Practice forbid anyone who may take part in deciding

this case, at any stage of the proceeding, from discussing the merits of the proceeding *ex parte* with any party or with any person who has been connected with the preparation or presentation of the proceeding as an advocate or in my investigative or expert capacity, or with any of their representatives (40 CFR 164.7).

Accordingly, the following Agency offices, and the staffs thereof, are designated as the judicial staff to perform the judicial function of the Agency in this proceeding. Notice of Intent to Cancel: The Office of the Administrative Law Judge, The Office of the Judicial Officer, the Administrator; the Deputy Administrator, and the members of the staff in the immediate office of the Administrator and Deputy Administrator. None of the persons designated as the judicial staff may have any *ex parte* communication with the trial staff or any other interested person not employed by EPA, on the merits of any of the issues involved in these proceedings, without fully complying with the applicable regulations.

Dated: February 19, 1967.

John A. Moore,

Assistant Administrator for Pesticides and Toxic Substances.

[FR Doc. 87-4473 Filed 3-3-67; 8:45 am]

SELLING CODE 0000-00-0

APPENDIX III.

DEMOGRAPHIC AND GENETIC BREEDING RECOMMENDATIONS FOR THE
CAPTIVE POPULATION OF BLACK-FOOTED FERRETS.

**DEMOGRAPHIC AND GENETIC CAPTIVE BREEDING RECOMMENDATIONS FOR
BLACK-FOOTED FERRETS**

Captive Breeding Specialist Group, IUCN

Prepared by:

**Jonathan Ballou
Dept. of Zoological Research
National Zoological Park
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a n d

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EDITOR'S NOTE: This appendix was prepared prior to the capture of the last known adult, therefore, the captive population of 17 ferrets is used for analysis.

I. INTRODUCTION

On August 15-17, 1986, the working group of the IUCN's Captive Breeding Specialist Group met in Laramie, Wyoming, with Wyoming Game and Fish Department and USFWS Personnel to discuss the management plan for the remaining black-footed ferrets located at Sybille, Wyoming. At that meeting it was recommended that a population biology management plan be developed for the management of the captive population of black-footed ferrets. The plan should address the genetic and demographic management of the captive animals as a population and should take as a priority the long-term preservation of the black-footed ferret as a species.

This report details the genetic and demographic management recommendations for the captive population of black-footed ferrets. These recommendations are made in accordance with the general recommendations outlined during the August 15-17 working group meeting of the CBSG that a plan be prepared detailing:

a) A propagation plan with goals for production in the F_1 and F_2 generations to achieve a secure self-sustaining captive population as the precursor to a release and reintroduction program;

b) Explicit population criteria for use of BFF from the Sybille colony to establish a 2nd geographically separate breeding population. This will be part of the analysis in (a) above. It was suggested that if 3 litters (9-10 animals) are produced in the 1987 season, then a breeding nucleus should be selected at a second population established in time to prepare for their breeding in the 1988 season. This should not be done in any way that will jeopardize reproductive success at Sybille in 1988.

c) Explicit criteria for conserving the status of the captive population for the initiation of a release and reintroduction program. It was noted that this will probably be about 200 breeding adults and will probably be F_2 or F_3 generation animals. Their removal must not compromise the status of the captive population. It may be appropriate to conduct small scale reintroductions with carefully chosen animals in order to perfect techniques. It was suggested that Meeteetse is the most suitable site at this time.

In addition, this report includes:

d) Explicit recommendations for establishing future captive BFF population sub-divisions; and

e) Recommendations on general strategies for maintaining genetic diversity in the captive population;

II. GOALS AND PRIORITIES OF THE FERRET BREEDING PROGRAM

In developing population management recommendations, it is imperative to recognize the primary goals and priorities of the captive breeding program. The recommendations for the B F F Breeding Plan were developed with the following goals and priorities in mind:

- a) The primary goal is the long-term preservation of the black-footed ferret as a species;
- b) The recent history of declining population trends and disease susceptibility of the wild population suggests that the long-term preservation of this species necessitates the establishment of a secure, self-sustaining captive population;
- c) Reintroduction of BFFs back into available natural wild habitat should be done as soon as possible while minimizing survival costs to the captive population;
- d) Of primary importance to the survival of both the captive and future wild populations is the maintenance of genetic diversity. Although the history of the Meeteetse population, from which the captive ferrets were collected, suggests that the population may have been isolated since the 1930s and could therefore have lost most of its genetic diversity (Lacy, in press), prudent management dictates that measures be taken to preserve what diversity is retained in the founding animals (Hedrick et. al, 1986; Allendorf and Leary, 1986). Therefore, once secure and over its 'critical' phase, the captive population will be managed under the goal of maintaining genetic diversity.

III. RECOMMENDATIONS FOR A GENERAL BREEDING STRATEGY

In light of these priorities and long-term goals, the following general strategies are recommended:

- a) The highest priority during the early 'critical' phase of the captive population is to increase the population size as rapidly as possible. Rapid growth of the small founding population is imperative for both genetic and demographic reasons. Small population size increases the risk of extinction due to demographic stochastic events and reduces the retention of genetic diversity (Gilpin and Soule, 1986). A rapid increase in the population size mitigates both these risks.

- b) When establishing pairings, those that maximize the retention of founder alleles in the offspring should be considered first. However, this must be done without compromising population growth. Mate selection for genetic compatibility should be a secondary consideration to reproductive compatibility. Genetic compatibility should consider minimizing

Continued

the levels of genetic relatedness between mates and assuring a diverse representation of founder alleles in future generations (Foote et. al, 1986). This is initially accomplished by guaranteeing that a maximum number of offspring from each founder pair reproduce in subsequent generations. At least 7 offspring per founder pair are required to be 95% certain that all the founders' allelic diversity is passed on to the next generation (Ballou, 1984).

c) Establish a breeding nucleus at a second site as soon as possible to mitigate the possibility of disease epidemics destroying the Sybille population (Dobson and May, 1986).

d) Data should be collected throughout the development of the population and analyzed periodically to evaluate the fitness, genetic, and demographic characteristics of the population. Types of data to be collected should include 'studbook' data (AAZPA & IZY Studbook Procedures) as well as morphological and genetic data (Wayne et. al, 1986).

e) Evaluate the levels of genetic variation in the existing ferrets through biochemical analysis. Biochemical analyses (electrophoresis, mitochondrial DNA, hypervariable DNA probes) may be useful in determining more accurately the relationships of the existing ferrets as well as determining paternity in cases where multiple matings occur. The goal to maintain genetic diversity and avoid breeding close relatives should not be abandoned if little or no genetic variation is found. Lack of variation does not imply total lack of genetic diversity and it may be vital to maintain what little genetic variation is present for the long-term fitness of the population.

f) Individuals with unusual (outlying) reproductive/ phenotypic/ fitness characteristics should not be culled or otherwise limited in reproductive potential. Both the genetic variation and demographic potential in these individuals should not be prejudiced by the occurrence of potentially deleterious characteristics assumed to be genetic (Frankham et al, 1986).

g) When the initial 'critical' phase of population expansion is complete (once 20 'potential' breeders are established in each of 2 populations, see below), more emphasis should be placed on maintaining genetic diversity. Such considerations include the following:

- i) establish pairings to maximize the number of surviving founder alleles and compensate for earlier non-optimal genetic pairings. This is accomplished through constant pedigree analysis and mate selection (MacCleur et al., 1986).
- ii) Utilize the genetic contributions of the original founders as long as possible, even if invasive techniques are required. This is accomplished through

preferentially breeding earlier-generation as opposed to later-generations individuals (i.e. continue to breed founders in preference to their off-spring; F_1 in preference to F_2 , etc.);

- iii) Evaluate the effects of inbreeding on the population's fitness utilizing data collected during the 'critical' phase of the population's growth (Ballou, this volume).
- iv) Expand the distribution and number of individuals into a number of population sub-divisions. Continue to recommend high rates of migration between sub-divisions until founder alleles are equally distributed between sub-divisions. Once this is accomplished, limit the degree of migration within the total population to one effective breeder per BFF generation, thereby establishing true genetic sub-divisions, maximizing the retention of genetic diversity and minimizing the potential for epidemiological disaster (Lacy, in press). Migration between sub-divisions should be rotated among sub-divisions. At least five population sub-divisions are recommended for the black-footed ferrets (Lacy, pers. comm).
- v) Establish an overall captive population carrying capacity sufficient to retain a specified amount of the genetic diversity originally acquired by the founding animals. Initial demographic models suggest that 500 total individuals (200 breeding adults during the birth season) will retain 80% of the founder's level of heterozygosity for 200 years (see Appendix B, Genetic Model) (Soule et al., 1986).
- vi) Through demographic management, maintain a stable captive population at or above this carrying capacity. Reproductive rates should be managed to support a stationary, stable population while supplying animals for reintroduction programs (Foose, 1982; Goodman, 1980).
- h) Demographic and genetic analyses should be conducted routinely during the development of the population. Estimates of potential growth rates, generation length, effective population size and rates of loss of heterozygosity should be updated. If necessary, the recommendations specified in this plan should be revised to adjust for more accurate estimates of these genetic and demographic parameters.
- i) Genetic and demographic recommendations for the reintroduction program need to be developed. These should include discussions of two-way exchange between the captive and wild populations and the selection of individuals for the reintroduction.

Continued

IV. BLACK-FOOTED FERRET CAPTIVE POPULATION MANAGEMENT OBJECTIVES AND RECOMMENDATIONS.

The specific management recommendations for the captive management of the black-footed ferret population are based on the general strategies described in Section III and were developed to achieve a series of sequential objectives. The basic objectives and their estimated time-frames are summarized in Figure 1. The recommendations for achieving the objectives are listed under each objective. The time-frame for the program has not been emphasized since the future growth of the population is uncertain and specific time-oriented recommendations are not possible. However, the models do enable us to estimate potential time-frames for the various stages of the management plan and we have included the estimated schedule from the results of the 'REALISTIC' population model (see Appendix A: Demographic Models).

For the purposes of the discussion below, the following terms are clarified:

+ All ferrets brought in from Meeteetse are labeled 'wild-caught.' However, these wild-caught animals consist of both 'founders' (by definition those ferrets that are unrelated to each other and whose genetic contributions are present in the living population) and 'F₁' generation animals (offspring of founders). The pedigree for the population with founders indicated as such, is shown in Figure 2.

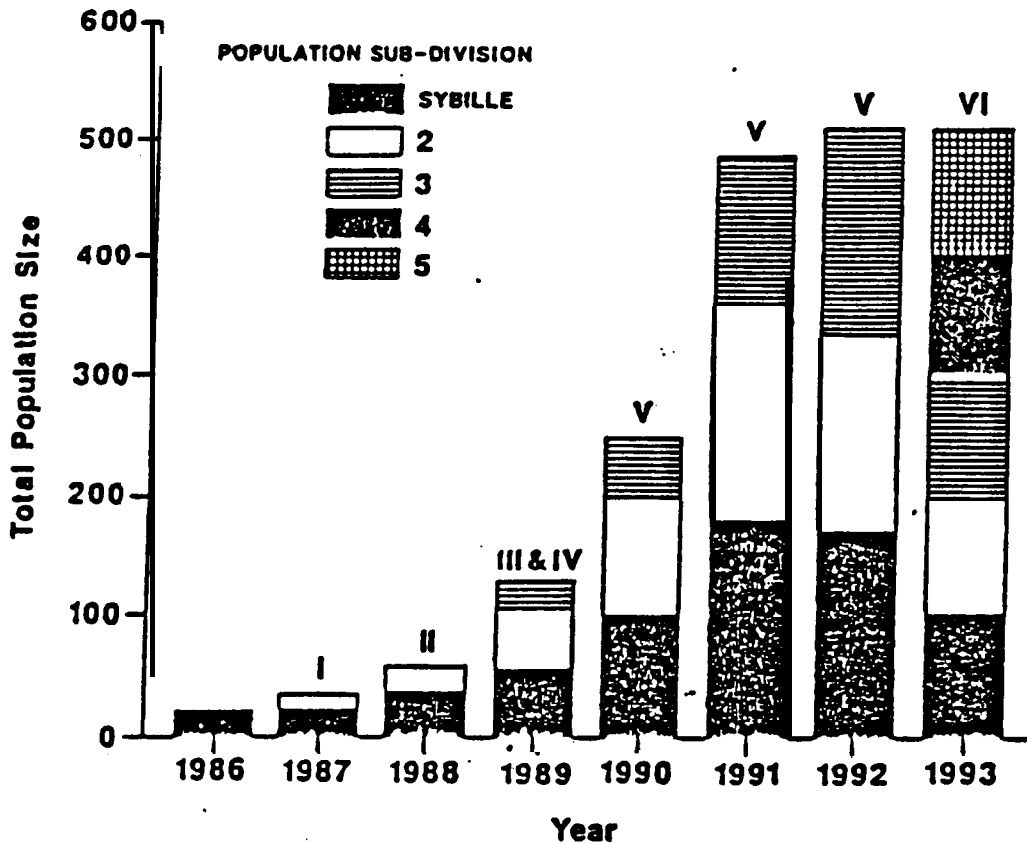


Figure 1. Estimated growth and distribution of the captive population of black-footed ferrets. Growth and time schedule estimates are based on the Realistic demographic model (See Appendix A). Roman numerals indicate the program objectives summarized below.

OBJECTIVES:

- I. Establish a breeding nucleus at a 2nd geographically separate location.
- II. Build the 2nd Population sub-divisions up to at least 20 potential breeders each.
- III. Establish at least 20 proven breeders in each population sub-division.
- xv. Establish a 3rd geographically separate sub-division of at least 10-10 potential breeders.
- V. Manage the three population sub-divisions as one genetic population, build the total population up to 500 animals.
- VI. Initiate reintroduction program, equalize distribution of founder alleles between population sub-divisions and divide the 3 subdivisions into 3 genetically separate populations in at least 3 geographically distinct facilities.

Continued

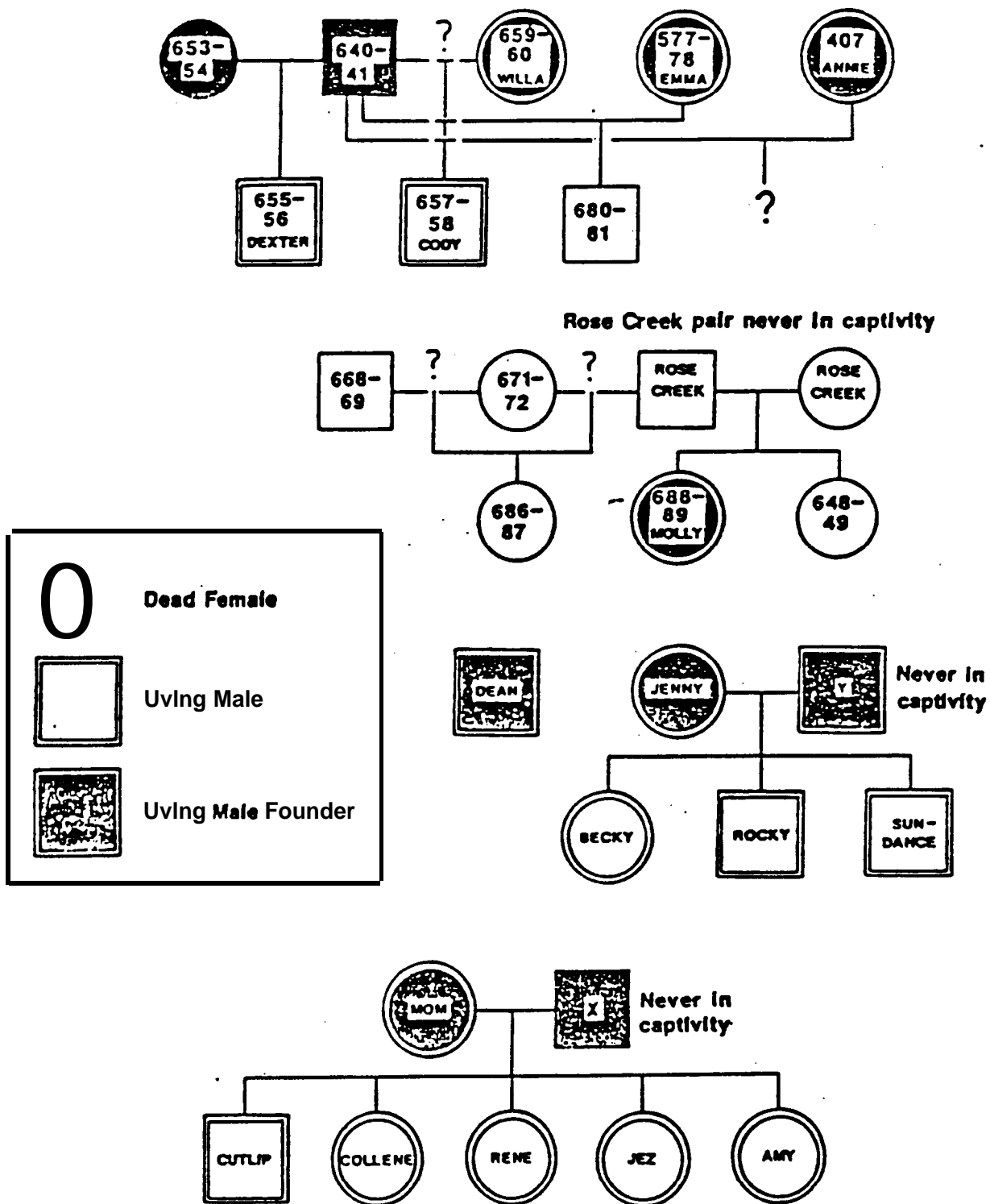


Figure 2. The pedigree of the 17 black-footed ferrets currently owned by Sybille. Circles are females, squares are males. Living animals are shown with double squares or circles. Animals that are considered 'Founders' have been shaded. There are four animals listed in the pedigree that have never been in captivity: Rose Creek female, Male 'X' and Male 'Y'. Male 'X' and 'Y' may be the same animal. Other uncertainties in the pedigree: Animal 686-87 may have been sired by either the Rose Creek male or Male 668-69. In addition, one of three females (Willa, Emma or Annie) may have been the dam of 657-58.

Continued

+ "Potential" breeders are individuals of breeding age, whose behavior and reproductive characteristics do not preclude them from breeding.

Objective Level I (Estimated Year 1987):

OBJECTIVE: Produce enough young from the 17 animals currently at Sybille to establish a F_1 & F_1 /Founder Backcross breeding nucleus at a second population sub-division (POP2) geographically separated from Sybille.

The second population sub-division should be established under the following *minimum* constraints. If the constraints cannot be met, a second population should not be established and all the Sybille animals should be kept at Sybille until reproduction is such that the conditions are met:

- a) Selection of pairings at Sybille should be made in accordance to Recommendations for a General Breeding Strategy specified in Section III above. Recommendations outlining specific preferred pairings for the initial 1987 breeding season are outlined in Appendix C.
- b) A maximum of 10 animals and a minimum of 3 males and 2 females should be sent to POP2.
- c) The wild-caught animals should preferentially be kept at Sybille.
- d) Individuals for POP2 must be selected so that no pairings would be between full sibs.
- e) In the event of highly successful reproduction during the first year, those produced in excess to the initial needs of POP2 should first be used to establish 10.10 potential and/or proven breeders at Sybille and secondly establish additional pairs at POP2.

Objective Level II (Estimated Year 1988):

- OBJECTIVE: Build the population sub-divisions at both Sybille and POP2 to at least 10.10 potential F_1 , Founder/ F_1 Backcross and founder breeders. (This objective may have already been accomplished in Objective I if reproduction at Sybille was outstanding, see I(e) above).

The following recommendations specify the order in which this objective should be accomplished:

- a) Breed animals in Sybille (founders in preference to F_1 or F_1 back-crossed to founder) to establish a breeding core of at least 10.10 potential breeders at Sybille.

Continued

b) Send additional captive-bred F_1 and F_1 /Founder Backcrosses to POP2 until POP2 has 10.10 potential F_1 breeders. Animals selected for POP2 should meet the following criteria:

- pairing combinations among animals sent to POP2 should not include full-sib pairings;
- The 10.10 potential breeders at POP2 should consist of a genetic representation of all founder ferrets that have bred up to that point and should closely resemble the distribution of founder alleles at Sybille;

c) Begin to breed the original breeding nucleus at POP2. Since offspring resulting from these matings will be in the F_2 generation, they should not be considered as contributors to the goal of establishing 10.10 potential F_1 and F_1 /Founder backcross breeders.

NOTE: Once 10.10 potential breeders have been established at both Sybille and POP2, the population's reproductive potential is fairly secure and the 'critical' phase of the population can be considered over. At this point, genetic criteria and the maintenance of genetic diversity take a higher priority and the general strategy recommendations related to the selection of breeding pairs outlined in Section III.g should be followed.

Objective Level III (Estimated Year 1989):

OBJECTIVE: Maintain and breed individuals at Sybille and POP2 until each population has 10.10 proven breeders with similar distributions of founder alleles.

This process should involve:

- a) Preferential breeding of earlier-generation (founder or F_1) as opposed to later-generation (F_2 , F_3) ferrets;
- b) Minimizing the degree of relatedness between mates;
- c) Transferring proven breeders (including wild-caught animals) between population sub-divisions as needed to equalize the distribution of founder alleles between sub-divisions. At least one effective breeder should be transferred between sub-divisions each ferret generation (2.5 years).

Objective Level IV (Estimated Year 1989):

OBJECTIVE: Reproduce individuals in Sybille and POP2 until

Continued

enough surplus are produced to establish a 3rd population sub-division (POP3) of 10.10 potential breeders geographically distinct from Sybille and POP2.

These 10.10 potential breeders should:

- a) Be early generation (F_1 or F_2) ferrets;
- b) Come from Sybille and/or POP2 as needed but not reduce either sub-division below 10.10 proven breeders;
- c) Be representative of the overall founder allele distributions existing in Sybille and POP2;
- d) Consist of potential pairings with degrees of relatedness no larger, and preferably lower, than the average degree of relatedness of breeding animals in Sybille and POP2.

Objective Level V (Estimated Year 1991-1992):

OBJECTIVE: Breed individuals within Sybille, POP2 and POP3 as one genetic population until a total effective population size of 250 is reached (estimated 500 total animals, 200 breeding-aged adults during the birth season; See Appendix B: Genetic Model). The carrying capacity will be considered to be 500 total animals. Note: These carrying capacity estimates are open to revision as additional information from the captive population is collected.

- a) Animals should be transferred between population sub-divisions as needed to continue to equalize the distribution of founder alleles between sub-divisions. At least one effective breeder should be transferred between population sub-divisions per ferret generation (2.5 years);
- b) Update demographic models using existing data to determine when reproduction will allow animals to be released;
- c) A limited number of animals can be used for experimental reintroductions when it can be shown through demographic modeling using data from the existing population that Objective Level V can be obtained within 2 years following the experimental release.

Objective Level VI (Estimated Year 1992):

OBJECTIVE: Initiate a full-scale reintroduction program using animals surplus to the population's stable maintenance needs and, once the distribution of founder alleles across Sybille, POP2 and POP3 is equalized, subdivide the total population into 5 genetically separate divisions of effective size 50 each.

Continued

a) Demographic modeling, based on data collected from the captive population to this point, should be initiated to determine reproductive rates of animals in Sybille, POP2 and POP3 necessary to maintain a stationary, stable captive population at carrying capacity (500 animals) and supply the needs of a full-scale reintroduction program.

b) Individuals selected for the reintroduction program should be selected so that the level of genetic diversity in the captive population is not compromised (reduced) by their removal. Therefore, those individuals should be descended from founders whose genetic representation in the captive population is not affected by the individuals removal. Pedigree analysis should be used to assist in determining individuals to be reintroduced.

c) Through the transfer of animals, equalize the distribution of founder alleles between population subdivisions.

d) Subdivide the total captive population into 5 genetically separate (but not necessarily geographically separate) divisions of effective size 50 each.

e) To maximize the retention of genetic diversity, there should be limited gene flow between subdivisions. Only one effective migrant per generation (est 2.5 year) within the total population should be transferred between subdivisions.

f) Within each subdivision, select pairings to minimize the degree of relatedness and maximize the allelic diversity.

g) To assure continued epidemiological protection, the 5 subdivisions should be distributed over at least 3 geographically separate facilities.

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APPENDIX IV
CAPTIVE PROPAGATION • TECHNIQUES AND PROTOCOL

CAPTIVE PROPAGATION - **TECHNIQUES** AND PROTOCOL

I. Personnel

- A. Don Kwiatkowski, Captive Breeding Biologist: day- to-day **care:** handling and shifting of animals for pairing.
- B. Tom Thorne, Wildlife Veterinarian: **overall** supervision and assistance with day-to-day care; shifting **of** animals for **pairing**.
- C. Huey Dawson, Supervisor Sybille Unit: assistance with day-to-day care; shifting **of** animals for pairing.
- D. Elizabeth Williams, U.W. and Kimberly Lutz, Wyoming **Game** and Fish: assistance with pairing and **monitoring fertility**.
- E. Brian Miller, U.W. Graduate **Student:** behavioral observations of animals for pairings.
- F. Other persons may assist with approval **of Thorne** or Dawson.

If. Time

- A. Pairing will begin once females are determined to be in standing estrus, based upon established and proven **cri-**teria **for** estrus detection. Pairing will continue until all likely females are bred **or** there is no hope **of** breeding.
- B. Pairings will be attempted primarily at night, although priority may be shifted to day time if experience indicates it is appropriate.

III. Monitoring

- A. Pairing will be videotaped.
- B. Written **records will be** made **of** each pairing by assigned personnel.

- Continued

IV. Detection of Estrus

- A. **Vaginal** cytology using techniques **of** 1987 will be the primary means of detecting estrus.
1. Vaginal **lavages** will be prepared weekly during anestrus and early proestrus, with increasing frequency as estrus approaches. **Comparison of** these values to those **of** last year **when** successful copulations **occurred** will be used to determine time introduction attempts.
- B. Measurements of **vulvar** swelling and **emperical** evaluation of **vulvar** appearance will guide and supplement cytology.
- c. Once cytology **and** vulvar swelling suggest a female to be in estrus, behavioral response may dictate the necessity for multiple **or** rotational introductions to males.

v. Detection of Male Fertility

- A. **Males** will be evaluated by electroejaculation **under** anesthesia.
1. Any male responding unfavorably to the **electro-**ejaculation procedure, i.e. posing a real threat to its health, will be sampled at a lower frequency than males unaffected by electroejaculation.
 2. Anesthesia and electroejaculation will not be performed within 2 to 3 **days before** a male is anticipated to be used for breeding.
 3. Efforts will be made to collect, analyze, and cryopreserve semen from all males, with a special emphasis **on** founder males.
- B. pairings between estrous **fitch** ferrets (currently in isolation at **Sybilie**) to black-footed ferret males may be attempted in an effort **to increase** experience and reproductive abilities **of** males and provide an additional, noninvasive method **of sperm** checking males prior **to their** pairing **with** black-footed **ferret** females.

- Continued

- c. Testis size of males will be measured/estimated opportunistically and as frequently as possible without undue stress to **the** animals.. This will begin in November.
- D. Vaginal **lavages** will **be** taken within 2 hours after observed copulation from selected female(s) based upon **their** temperament. These will be examined **for the presence of sperm.**
- E. At the end of the breeding **season**, select males will **be** **●** electroejaculated under **anesthesia for sperm characterization** and cryopreservation.

VI. Breeding Protocol

- A. Male-female pairing will be conducted under the jurisdiction of **assigned** personnel on an hour-to-hour, **day-to-day** basis. Whenever possible, handling and shifting of animals will be limited to those people with **whom** the ferrets have previous familiarity.
 - 1. **Where possible, pairings will be** based upon genetic considerations based on an optimum pairing plan. The optimum pairing **plan** will be annually prepared by T. Thorne, WGFD and **J. Ballou, CBSG.**
 - 2. If genetically preferred pairs are incompatible or nonproductive, emphasis will **be** on productive breeding using any pair that will result in **successful** mating.
- B. Estrous females will be paired with successive males until successful copulation is achieved.
 - 1. On **selective basis**, receptive females may be bred on 2 successive days to 2 different **'males.**
 - 2. Based upon individual temperament and behavior, receptive females may be left with a breeding male **up** to 24 hours.
- c. Estrous females will be paired with successive males until successful copulation is achieved.
 - 1. If other females are known to be in **estrus**, and only one male is participating in breeding activities, the male which has just successfully bred a female will be **removed so** that additional matings **with** other females might be obtained.

2. **A single** male will not be allowed to inseminate more than 2 females per day.
 3. **Each** receptive female will be bred on 2 successive days to the same male, after which no further introductions to the male will be attempted.
- D. If necessary, artificial insemination **may** be attempted.
1. Natural insemination will be preferred **over** artificial means.
 2. **All** consideration of artificial insemination is **predicated** on ongoing research to develop **safe**, reliable techniques-
 3. **The** only candidates for artificial insemination **will be** mature (> 1 year-of-age) females.
 4. Nonsurgical **methods** (which have not **been** developed) will be preferred over surgical techniques: **laparoscopic** techniques will **be** preferred over laparotomy.
 5. **If** copulation is observed to occur, but no sperm are found in **a** vaginal smear, special attention will be **needed** as ovulation **and pseudopregnancy may** occur. When such cases arise, the female should immediately be rebred to another male (if available) or housed with the **same** male **and** closely watched **for** up to 30 hours. If no other matings occur, the female should be considered **a** candidate for artificial insemination.
 6. If one **or** more older females fail to breed and become anestrus, **they** will be considered candidates for ovulation **by** injection of suitable hormones and artificial insemination.
 - a. It should be recognized that hormone **injection** may **be** detrimental to the long term reproductive health **of a** female.
 7. If laparotomy or laparoscopic artificial insemination techniques are utilized, provisions will **be** made to transport personnel and necessary **equipment** to conduct **this** procedure from the **laboratory of** Dr. David Wildt, Smithsonian Institute, National zoo, Washington, D.C. Arrangements will have to be made within 12 to 24 hours **of** a decision to artificially inseminate **a** female (February through **May**).

- Continued

8. Consideration will be given to attempting to artificially stimulate sexual maturation of the 1 year old male, Cody, that so far has failed to develop sexual maturity.

VII. Whelping Management

- A. Tours and unnecessary visitation will not be **permitted** during this **period**.
- B. Bred females will be provided with at least 2 nest boxes.
- C. Pregnant females that **resorb their young, or lose their** young within a **few days** postpartum, will be **periodically** tested for recurrence of estrus. Attempts to breed such females will be made.
- D. Particularly nervous pregnant females will be placed in isolation during gestation.
- E. Monitoring **of** bred females and offspring will be via nest box cameras when possible; physical inspections will be by familiar personnel when **necessary**.
- F. Cross-fostering will be attempted only **if** disease **free** fitch **ferrets** or domestic ferrets can be obtained."
 1. Synchronous fitch ferrets 'from the **isolated Sybille** colony **will** be used, or bred domestic ferrets will **be ordered** from large commercial producers the day black-footed ferrets are bred: Only Aleutian disease test free ferrets will be **accepted**.

VIII. Disease Prevention Protocol

- A. Introduction **of** disease will be considered the **greatest** threat to **the** small number **of** black-footed ferrets in captivity. The importance of breeding and small number of animals to work with necessitates maintaining all captive animals together in a single building. In all considerations, prevention of disease will be given highest priority.
- B. Isolation.
 1. Black-footed Ferret Captive Propagation Building will **be** locked except when an attendant is **present**.
 2. Access will be strictly limited to assigned personnel and necessary visitors **approved** by Tom Thorne or Huey Dawson.

- Continued

C. Access by assigned personnel living at Sybille.

1. **If** an attendant has been away from **Sybille** or in the presence of dogs **or** other carnivores within 24 hours, guidelines **for** assigned personnel and **visitors** not living at Sybille (**D.**); will be followed otherwise:
2. Rinse footwear **in** disinfectant upon entering building.
3. Before handling items **that** ferrets may contact, e.g. food, **cages**, syringes, etc., wash hands and **rinse** in disinfectant.
4. Before handling **food**, wear **a** surgical mask.
5. Before **entering** ferret rooms, hands will **be washed and rinsed in** disinfectant **and a surgical mask and** laboratory **coat** will be **worn**.
6. **Personnel who** have influenza will not **enter the** building.

D. Access by assigned personnel and visitors not living at Sybille.

1. Before entering **the** commissary or ferret **rooms**, **a shower** will be taken and **coveralls** and surgical masks' will **be worn**.
2. Street shoes and footwear will **not** be worn beyond the office and outer dressing room.
3. Personnel and visitors who have influenza will not **enter** the building.

E. Food Animals

1. Food animals will not be offered until **they have been shown**, to be healthy over a **7** day period.

F. Other Animals.

1. With the exception **of fitch ferrets** from the **isolated** Sybille colony, **no** animals susceptible **or** thought to **be** susceptible to diseases known **or** thought to affect ferrets will **be** allowed in the building.

- Continued

2. Any stray or trespass domestic and wild animals **will be** removed from **the 'Captive** Propagation Compound as quickly as possible by any means necessary.
3. **Sybill** staff **will be** required to have pets appropriately vaccinated and limit **the** number of **pets** to those present at this time.

G. Duration.

1. These precautions will **be** enforced **at** least until 3 populations have been established.

H. Vaccination.

1. Captive black-footed **ferrets** Will be vaccinated with inactivated canine distemper virus vaccine **prepared by-** Dr. Max Appel with adjuvant prepared by Ft. Dodge Laboratories' following **protocol** recommended by Dr. Max Appel **and** Ft. **Dodge** Laboratories.

xx. Other Precautions .

- 'A. Appropriate smoke alarms have been instilled in the Captive Propagation Building and Captive Breeding Biologist's residence.
- B. Fire extinguishers have been installed in the Captive Propagation Building.
- c. A **ferret** evacuation plan in the event of **fire** has **been** prepared.
- D. The gate to **the** Captive Propagation Compound will be locked when there is **not** an attendant present.
- E. **The Sybill** Unit will **not** be left unattended.

BLACK-FOOTED FERRET PREFERRED PAIRING PLAN

	Dean ³	Dexter ²	Cody	Rocky	Sundance	Outlip	Scarface ^{1,2,3}	Fennis	Sully
Molly ³	p6	37					2		
Willa ³	27	3	X? ⁴				P		
Emma ^{1,3}	2	3	X?				P		
Annie ^{1,3}	2	3	X?				P		
Jenny ^{1,2,3}	P	2	3	x ⁵	X				
Mon ^{1,3}	P	2				X	3		
Becky ²	P	2	3	X	X			X	X
Collene	2	P	3			X	X		
Rene	P	2	3			X	X		
Jez	2	P	3			X	X		
Amy	2	P	3			X	x		
Shelly	P	X	2	X	X		2		
Laverne	2	P	3	X	X	X	X	X	X
Hannah	P	2	3	X	X	X	X	X	X
Mesteetsee	2	P	3	X	X	X	X	X	X
Sadie	P	2	3	X	X	X	X	xX	X

- 1 Known breeder when free-ranging
 2 Know productive breeder in captivity
 3 Founder
 4 X? denotes possibly related
 5 X denotes closely related
 6 Preferred pair
 7 Second or third choice pair

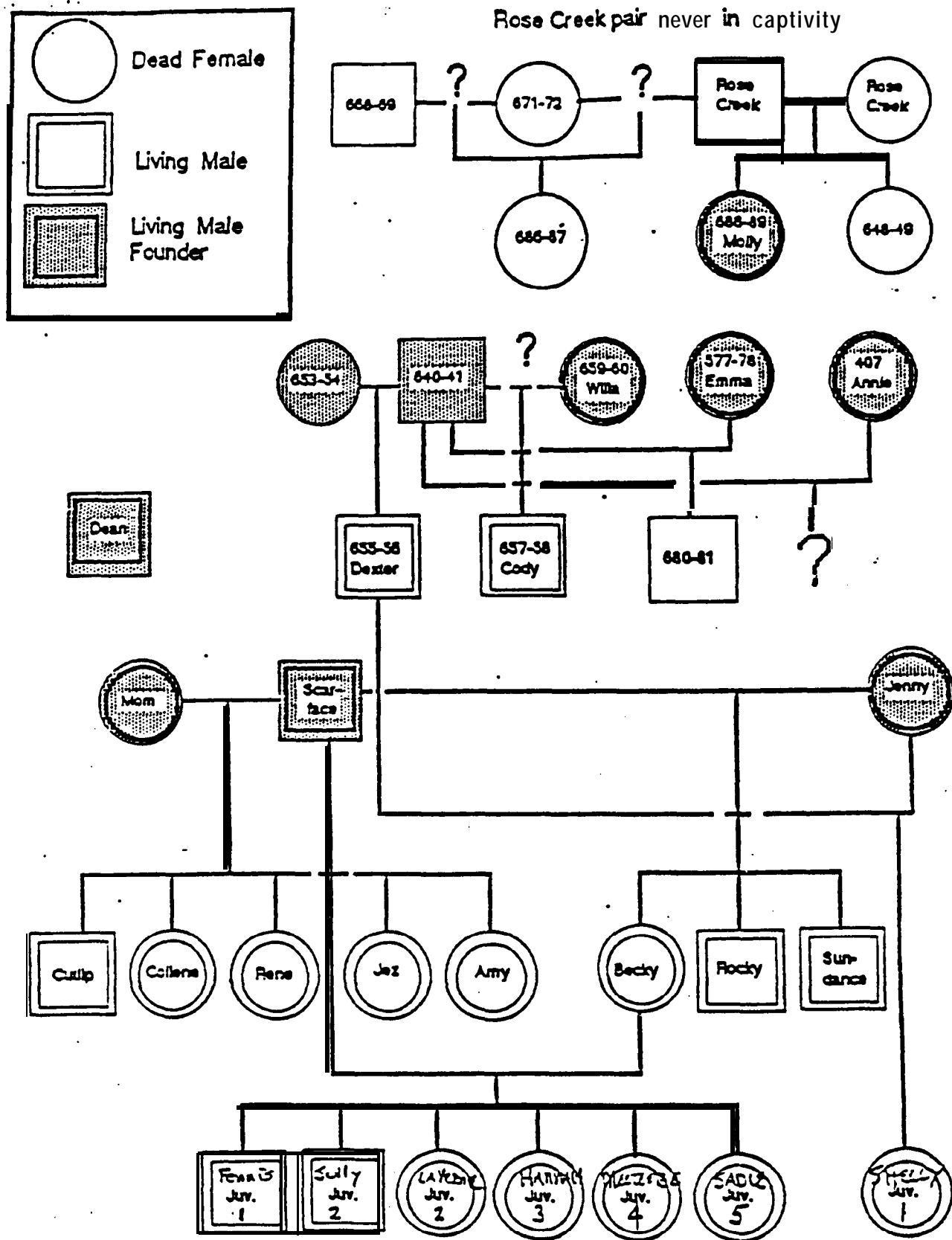


Figure 1. Pedigree of captive black-footed ferrets.

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