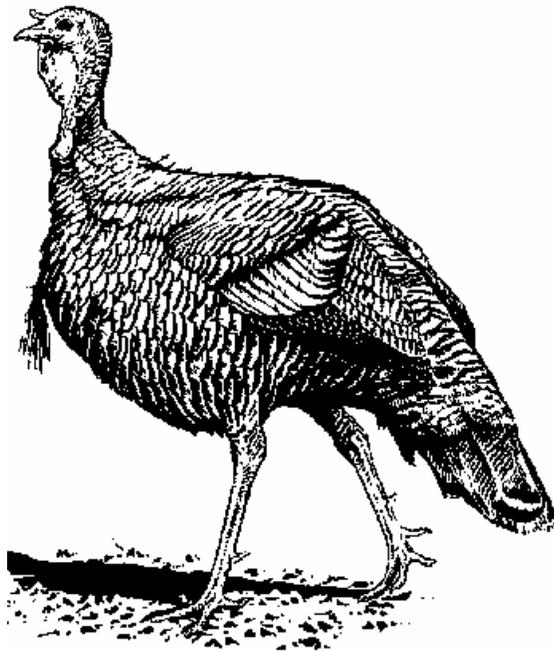


Southeastern Arizona Wild Turkey Management Plan



Compiled by:
Jim Heffelfinger, Tucson Region, AGFD
Brian Wakeling, Research Branch, AGFD
John Millican, Wildlife Manager, AGFD
Sheridan Stone, Fort Huachuca
Tom Skinner, Coronado National Forest, USFS
Mark Fredlake, BLM
Mark Adkins, NWTf

March 2000

TABLE OF CONTENTS

GOAL.....	3
OBJECTIVES.....	3
PURPOSE AND NEED.....	3
SCOPE.....	4
BACKGROUND.....	4
The Gould's turkey.....	4
Historical Distribution.....	5
Historical Translocations.....	6
POPULATION MANAGEMENT.....	8
Surveys.....	8
Translocations	10
Harvest.....	12
HABITAT MANAGEMENT.....	13
Prescribed and Natural Fires.....	13
Wood Cutting.....	14
Planting Mast Seedlings.....	16
Grazing Management.....	16
Fertilizing Native Vegetation.....	17
Wet Meadow Establishment.....	18
Water.....	18
OTHER MANAGEMENT OPTIONS.....	19
Supplemental Feeding	19
Food Plots.....	20
Predator Control.....	21
FUNDING.....	21
RESEARCH NEEDS.....	22
LITERATURE CITED.....	22

SOUTHEASTERN ARIZONA WILD TURKEY MANAGEMENT PLAN

GOAL

To establish self-sustaining populations of Gould's turkeys (*Meleagris gallopavo mexicanus*) throughout southeastern Arizona. Specifically, the objectives of this plan are:

OBJECTIVES

- (1) To maintain a viable Gould's turkey population in the Huachuca Mountains for use as a source to re-establish Gould's turkeys in other southeastern Arizona mountain ranges with suitable habitat,
- (2) To maintain and improve occupied and potential turkey habitat in southeastern Arizona,
- (3) To restore and sustain breeding populations of Gould's turkey in all areas of suitable turkey habitat in southeastern Arizona,
- (4) To offer permitted spring gobbler hunting when appropriate and use funds for research and restoration, and
- (5) To explore remote sensing technology to identify and prioritize turkey habitat for future translocations of turkeys,

PURPOSE AND NEED

The purpose of this plan is to provide guidance to agencies and organizations involved in the conservation and management of turkeys and their habitat. Strategies are listed for various management actions which are based on research or management experience. Insufficient information at this time precludes a more detailed implementation schedule with specific projects and funding needs. The information and strategies contained in this plan should help guide the development of such specific actions. Specific projects are already being planned and will be funded and implemented on an individual basis.

The goal for turkeys in the Arizona Game and Fish Department's (AGFD) Wildlife 2000 strategic plan is to "*Maintain turkey populations at levels that provide diverse recreational opportunities. Maintain and enhance turkey habitat through cooperation with land management agencies.*" Two Wildlife 2000 objectives for turkey are pertinent to Gould's turkey: (#5) Maintain existing occupied habitat, with emphasis on contiguous medium and high quality habitats and (#6) Maintain the range of all subspecies in Arizona by repopulating historical range through transplants; emphasizing reintroduction of Gould's turkey. Wildlife 2000 Species Specific Strategies that apply are (#5) Establish self-sustaining populations at all transplant sites. (#6) Provide hunter recreation that stresses the quality of the hunting experience.

Gould's turkeys were thought to occur in all suitable mountain and riparian habitat in southeastern Arizona at the time of European contact (Rea 1980). These birds were extirpated by

1920 and AGFD used mostly Merriam's turkey from northern Arizona in the 1940s and 1950s to reestablish turkey populations in the mountains of southeastern Arizona. These Merriam's turkey translocations met with limited success and it was thought that the Merriam's subspecies might not be as well adapted as Gould's turkeys to the mountain ranges in southeastern Arizona. Gould's turkeys were brought from Mexico in the 1980s and released in the Huachuca Mountains where a small population remains. It was not known if the Huachuca turkey population was genetically contaminated with remnant Merriam's turkeys still present in the Huachuca Mountains. Because of this concern, additional translocations in the 1990s used Gould's turkeys from Yecora, Sonora, Mexico in an attempt to establish another Gould's turkey population in the Galiuro Mountains. Subsequent genetic work found that the Huachuca turkeys were genetically consistent with the Gould's in Sonora and no evidence was found of genetic contamination by Merriam's turkeys. Because of difficulties in obtaining more turkeys from Mexico, future Gould's restoration efforts will focus on using the Huachuca turkey population as the source for the restoration of Gould's turkeys in southeastern Arizona. This will entail nurturing the Huachuca population, eliminating any remnant Merriam's turkeys in historic Gould's habitat, and translocating Gould's to all suitable, historic habitat.

SCOPE

This plan covers southeastern Arizona, south of the Gila River and east of the Baboquivari Mountains, which is thought to be the historical range of Gould's turkey in Arizona. Management actions apply to all suitable turkey habitat, but the Huachuca Mountains are emphasized because this area currently presents the best opportunity to increase a Gould's turkey population to use as a source for translocations. If the Huachuca population cannot be increased to serve as a source for translocations, we will have to reassess the feasibility of using the Huachuca population and renew negotiations with Mexico.

BACKGROUND

The Gould's turkey

The Gould's turkey of northern Mexico and the American Southwest is the "5th" subspecies of wild turkey in the United States. Although Gould's turkeys seem abundant and well distributed in Mexico, they occur only in a few isolated areas in southwestern United States: (1) Huachuca Mountains, AZ, (2) Peloncillo Mountains, AZ and NM, (3) Galiuro Mountains, and (4) some riparian areas of southeastern Arizona, such as Bonita Creek, San Pedro River and San Bernardino Valley. Compared to Merriam's, Eastern, Rio Grande, and Osceola, little is known about this turkey subspecies that was first described by J. Gould. There is no type specimen designated for this subspecies, but its description was based on a single specimen collected in 1892 south of the Animas Mountains in extreme southwestern New Mexico.

There are physical differences that set the Gould's turkeys apart, with some overlap of characteristics with other subspecies. In appearance, the Gould's turkey looks most similar to the Merriam's turkey (*M. g. merriami*). However, the body feathers have more iridescence than Merriam's turkey. Spurs in adult Gould's males are small or sometimes completely lacking; even older gobblers commonly have only 2 inch spurs (Stangle et al. 1992, Wakeling,

unpublished data).

The most notable difference from other turkeys is the color of the terminal band on tail and rump feathers, which is white, giving the Gould's turkey a decidedly white rump. The white tail band on the Gould's turkey is also wider. The Merriam's turkey terminal tail band is more cream or buff color when compared to a Gould's, although some Merriam's also have pure white tail bands. When seeing their first Gould's, many turkey enthusiasts remark about "all the white" on the bird.

Historical Distribution

Historical distribution of Gould's turkey was throughout the Sierra Madres in the Mexican states of Sonora, Chihuahua, and Durango, and south to the Balsas River Valley (Leopold 1959). North of the border, Gould's probably inhabited most riparian corridors and isolated mountain ranges in southeastern Arizona and southwestern New Mexico (Rea 1980). The present range in Mexico may be somewhat smaller than its historical range, but this bird is still widely distributed throughout the extensive Sierra Madres.

No physical documentation exists for the original specimen collected in New Mexico, 1892. Turkeys were definitely present in mountains and along riparian areas of southeastern Arizona at the time of early Anglo exploration, but definitive data on the subspecies that occupied these ranges are lacking. Given that there appears to be more turkey habitat connectivity to the south than the north, it seems logical that birds in southeastern Arizona in the late 1800s were more likely Gould's turkey, rather than the Merriam's (Rea 1980). These original populations declined as the westward expansion of settlers reached southern New Mexico and Arizona. By the First World War, turkeys had largely disappeared from southeastern Arizona. Historical populations of Gould's turkey have held on in the Peloncillo, Animas, and San Luis mountains in southern New Mexico near the Arizona boundary. A small but apparently stable population of Gould's still inhabits this area and was monitored for over a decade (1980s) by Dr. Sanford Schemnitz and his graduate students at New Mexico State University (Potter 1984, York 1991). In recent years, turkeys have been observed in the Bonita Creek, San Pedro and San Bernardino drainages in Arizona. These may be Gould's turkeys from riparian areas near Cananea, Sonora, Mexico less than 60 miles to the south. Today, the separate mountain ranges are increasingly isolated from one another by highways, cities, and altered habitat (riparian and upland). Dispersal and recolonization potential is much reduced in this modern landscape.

Historical Translocations

Starting in the late 1930s, an aggressive restocking program by AGFD transplanted turkeys into most mountain ranges with turkey habitat (Engel-Wilson 1997). Most of these early transplants used the Merriam's subspecies throughout southeastern Arizona mountains.

Translocations of turkeys 1939-97 into southeastern Arizona (Engel-Wilson 1997).

Mountain Range	Year	Number released	Subspecies	Current Status
Catalina	1939	19	Merriam's	Small remnant
	1940	15	Merriam's	
Chiricahua	1939	8	Merriam's	Small remnant
	1940	3	Merriam's	
	1940	12	Gould's	
	1941	7	Merriam's	
Pinaleno	1940	16	Merriam's	A few individuals ?
	1944	11	Merriam's	
Santa Rita	1946	13	Merriam's	Small remnant
Huachuca	1950	46	Merriam's	Over 50 Gould's
	1983	9	Gould's	
	1987	12	Gould's	
Dos Cabezas	1955	30	Merriam's	None
	1956	13	Merriam's	
	1960	13	Merriam's	
	1961-62	12	Rio Grande	
Galiuro	1994	21	Gould's	At least 8
	1997	46	Gould's	Gould's
Atascosa	1961-62	69	Rio Grande	None

The early Merriam's turkey transplants into the drier mountain ranges of southeastern Arizona were successful at first, but over time, every population declined to extirpation or very small remnants. Reasons for this lack of success are unclear, but it has been hypothesized that Merriam's turkeys are not as well adapted to climatic and habitat conditions prevalent in southeastern Arizona, or limited recolonization hampered the formerly dynamic nature of a larger southeastern Arizona metapopulation. Individual populations may have fluctuated independently in response to climate and habitat quality, occasionally becoming extirpated, to be subsequently recolonized by a neighboring population via movement corridors.

In the 1980s, an attempt was made to reintroduce Gould's turkeys in the Huachuca Mountains. The Huachuca Mountains southeast of Tucson contained a remnant population of Merriam's turkeys from an early translocation in 1950. In order to guard against the genetic dilution of the incoming Gould's turkeys, liberal hunting seasons and an active trapping program was instituted. As many Merriam's turkeys were removed as possible in the late 1970s and early 1980s. The last harvest on the Fort Huachuca Military Reservation (approximately half of the Huachuca Mountains) was in October of 1981 in the mouth of Sawmill Canyon (S. Stone, pers. commun.). By 1982, neither Fort Huachuca personnel nor hunters could locate any remaining

turkeys.

In 1983, 17 Gould's turkeys were brought into the U.S. and quarantined for 30 days, in accordance with U.S. Department of Agriculture regulations for imported live poultry. Of the 17 brought to the U.S., nine survived the quarantine and were released in May.

In 1987, 29 additional birds were imported and quarantined on Fort Huachuca. After quarantine, 12 surviving Gould's turkeys were released, including five bearded toms. A drought occurred in the late 1980s, and the newly released turkey population seemed to have struggled under adverse habitat conditions. However, in 1990, somewhat normal rainfall returned to the region, and the population seemed to increase (in numbers and distribution) for several years, before declining during the drier conditions of the late 1990s.

This population was not looked at as a source of Gould's turkeys for translocations in other southeastern mountains because some biologists suspected that Merriam's turkey may have remained undiscovered in the Huachuca Mountains and interbred with the new arrivals from Mexico. Therefore, it was unknown if this population represented a pure strain of Gould's turkeys upon which to base re-establishment of the Gould's subspecies in all of southeastern Arizona.

A cooperative effort between AGFD, U.S. Forest Service (USFS), Southeastern Cooperative Disease Study Group, National Wild Turkey Federation (NWTFF), and Mexican biologists at Centro Ecologica de Sonora yielded the most recent chance to re-establish a widespread distribution of Gould's turkeys in the U.S. In 1993, permission was obtained to live-trap Gould's near the village of Yecora, Sonora, Mexico, and release them into the U.S. without the 30-day quarantine. This was a major break-through, because it was believed that high mortality during quarantine had limited success of past transplants.

A total of nine yearling males (jakes) and 12 females (hens) were trapped in January 1994 and released at Knob Hill Tank in the Galiuro Mountains. The Galiuro Mountains were selected due to the lack of a remnant Merriam's turkey population and its relative isolation. Because the subspecific identity of Huachuca birds was not known at that time, it was hoped that this new transplant would serve as a source population for Gould's turkey transplants into other southeastern Arizona mountain ranges. However, all male turkeys were dead within two months. By June 1995, only four females remained alive, the last one dying in October 1996 (Wakeling 1998). Collaborative efforts once again resulted in another translocation from Yecora, Sonora, to the Galiuro mountains in January-February 1997. Forty-six turkeys (19M:27F) were released at Knob Hill Tank. This second release suffered similarly high initial mortality. By June 1997, nine turkeys remained alive (3M:6F), and no nesting attempts were documented (Wakeling 1998). Reconnaissance in the summer of 1998, however, confirmed the existence of three poults produced during the 1998 nesting season; these poults have not been seen subsequently and their fate is unknown.

Genetic analysis conducted on turkeys from Sonora, Mexico, and Arizona identified a molecular (genetic) marker, that showed a "fixed" or diagnostic difference between Merriam's from northern Arizona and Gould's from Yecora, Sonora. Turkeys from the Huachuca Mountains were genetically consistent with Gould's turkeys from near Yecora (Mock et al. 1999). Morphologically, these birds also look more like birds observed and trapped near Yecora.

If the population of Gould's turkey in the Huachuca Mountains can be increased or

maintained, it can serve as a source population for transplants into other suitable habitats in southeastern Arizona. There is a need to have a Gould's turkey source population in the United States, because it is problematic to translocate turkeys from Mexico.

POPULATION MANAGEMENT

Surveys

The responsibility of turkey management lies with AGFD. Historically, summer (early July) surveys were conducted along standardized routes in southeastern Arizona (GMUs 29, 31, 33, and 35)(AGFD 1961). These routes were discontinued, because they did not yield sufficient sample sizes upon which to base management decisions. Summer classifications and incidental observations continued in some mountain ranges in conjunction with other activities to the present.

Accounts from the 1970s indicated the translocated populations in southeastern Arizona had already dwindled to relatively few birds. O'Brien (1976) noted that, based on turkey sign, there were probably less than 25 turkeys in the Huachuca Mountains in 1975-76. Common sighting areas included: Garden, Turkey, Korn, Lyle, Parker, and Scotia canyons. During that same year, Kim Murphy (AGFD) reported only two toms and 12 hens observed during field activities in the Chiricahua Mountains, involving 116 miles of foot and horseback surveys in "better turkey range." Flocks were small and no young birds were seen. In 1976, John Stair (AGFD) received reports and personal observations totaling 20-30 turkeys despite spending a considerable amount of time in good turkey habitat in the Catalina Mountains. Fifty-six fall turkey hunters in the Catalina Mountains that year harvested no turkeys and no young were seen. The harvest increased, however, in the early 1980s, only to decline again during that decade.

Population estimates for southeastern Arizona Merriam's turkey ranges in 1981 (from Olding 1982).

Mountain Range (GMU)	Population Estimate	Comments
Chiricahua (29)	110	
Peloncillo (30A)	40	Primarily in New Mexico
Pinaleno (31)	30	Declining
Catalina (33)	200	
Santa Rita (34A)	30	
Huachuca (35A)	30	Stable (pre-Gould's)
TOTAL	440	

Emory (1848:78) reported turkeys along the San Pedro River corridor in the mid-1880s, and sporadic observations continue to this day. Surveys were conducted along the upper San Pedro River in April-May of 1992-94, but only documented turkey presence. These surveys yielded a single set of tracks in 1992, tracks and scat in 12 locations in 1993, and no sign in 1994. This area was certainly used by turkeys, but in apparent low numbers.

Beginning in 1993, surveys have been conducted in the Huachuca Mountains in April in conjunction with personnel from the USFS, NWTF, Nature Conservancy, and residents of

Ramsey Canyon. These surveys resulted in turkey distribution, sex/age classifications, and an estimate of the minimum number of birds in the population.

Results of annual spring turkey surveys in the Huachuca Mountains.

Year	Number observed/heard	Locations
1993	9 (7M:2F)	Sawmill, Scotia, Sunnyside
1994	44	Ramsey Canyon, Patagonias, FR 49 Santa Nina, Huachuca Canyon, Peterson Ranch, Pyeatt Ranch
1995	25 (13M:19F)	Copper Glance, Sawmill, Scotia
1996	37 (16M:21F)	Ramsey Canyon
1997	15	Ramsey, other
1998	14	Sunnyside, Ramsey, West gate guard house
1999	41 (20M:21F)	

Sporadic reports are received of turkeys along Bonita Creek, in the San Bernardino Valley, and also in New Mexico in the Animas and Peloncillo mountains. Just south of the international border, turkeys occur in the Sierra los Ajos near Cananea, Sonora.

Currently, no survey techniques have been developed to estimate density or total population size of turkeys (Hoffman et al. 1993). Depending on the management objective, water hole track-counts, hunter surveys, spring gobbling counts, summer classification surveys, and winter flock surveys are recommended to index distribution, population size, and characteristics. In northern Arizona, summer roadside counts were found to be inefficient. While AGFD is currently conducting turkey research (with bait sites) in the Huachuca Mountains, winter flock surveys at the bait sites offer the best opportunity for estimating the minimum number of birds in the population. In the absence of organized research providing bait sites in the winter, spring gobbling counts may represent the only feasible survey alternative in southeastern Arizona. Spring gobbling surveys could be used in any mountain range with sufficient turkey densities.

Strategies:

- (1) Observe winter bait sites intensively, to obtain a minimum population estimate.
- (2) Continue annual spring surveys of the Huachuca Mountains as presently organized by John Millican (AGFD) and Sheridan Stone (Fort Huachuca). Surveys should all be done in two days to minimize the possibility of double counting. Surveys will yield presence and minimum number of individuals, rather than an index of abundance, but recording the effort expended (time spent surveying) would establish an index of birds per unit effort.
- (3) All other turkey observations should continue to be recorded incidentally in a consistent format.
- (4) Turkeys observed should be clearly classified to sex and age, and locations plotted on a map of the area.

- (5) All observations should have Universal Transverse Mercator (UTM) coordinates recorded

and entered into an electronic database that could be imported into a Geographic Information System for data analysis. This database should include UTM coordinates, date, flock size, age and sex composition, and any markings noted.

- (6) This information should be included in the annual AGFD Federal Aid report to provide for consistent recording.
- (7) AGFD, Fort Huachuca, and USFS personnel are encouraged to check for and record tracks around water sources to document distribution. This information should also be included in the UTM database. All known water sources should be surveyed during dry periods for an estimate of distribution.
- (8) Research efforts will explore the feasibility of using trailmaster cameras to obtain an index of the population.
- (9) Evaluate other survey methodology, such as fall survey routes to index poult recruitment and to provide another source of minimum population.

Translocations

Around the turn of the 19th Century, turkey populations throughout this country were dramatically reduced. Early efforts to re-establish turkey populations in some states with pen-reared birds proved unsuccessful. Turkey populations in other states recovered because of restrictions in harvest and techniques for translocating turkeys were developed and perfected. After the 1950s, translocation efforts intensified and thousands of turkeys have been moved into unoccupied habitat. Nearly all suitable turkey habitat in the U.S. is now occupied by turkeys (Kenamer and Kenamer 1996).

Contrary to success elsewhere, early translocations of Merriam's turkey in southeastern Arizona were not successful in establishing persistent populations. It is not known if supplemental translocations would have resulted in the success of these efforts, nevertheless southeastern Arizona remains one of the few areas in the country lacking turkeys. Therefore, it is desirable to attempt to re-establish the Gould's subspecies in southeastern Arizona, however, it will be difficult to obtain more Gould's turkeys from Mexico. Because of health and permit issues with Mexican turkeys, translocation from within the U.S. is the preferable way to establish a Gould's turkey population in Arizona. The Huachuca population currently seems to be the only one that could presently serve as a source for Gould's turkey. The Peloncillo Mountains on the New Mexico-Arizona line also has Gould's and may hold potential for the future as well.

Whether removing birds for translocation is additive or compensatory loss to the population is extremely variable and depends on habitat conditions. Carrying capacity varies almost weekly, but in the long term, populations should increase if there are abundant resources available. Depending on the habitat quality of the source population versus the target site, it may even be acceptable to translocate birds from a declining population if habitat conditions are better in the target mountain range. If the source population is declining because resources are limited, any birds removed may have died anyway. These decisions can only be made on a case-by-case basis. Assessment of carrying capacity is very difficult and inexact, therefore can not be used in intermountain translocation decisions. No diseases have been identified in all recent work on Gould's turkeys, and no disease concerns have emerged.

The major consideration for removing birds from a population should be: does the action

advance our goal of establishing and maintaining Gould's turkeys in southeastern Arizona?

Strategies:

Source populations

- (1) Discussions should be continued with New Mexico Department of Game and Fish to ascertain the potential to use the Peloncillo Mountains as a source population. This option is unlikely because of the State Endangered status of Gould's turkey in that state. However, the turkey population in the Peloncillo Mountains should be sampled and tested for disease and subspecific affinity (i.e., genetic markers) as soon as possible to determine if this is a likely source population. Genetic analysis of this turkey population should include samples of domestic birds from a nearby area to assess the possibility of hybridization, which had been indicated by field observations in Guadalupe Canyon, Arizona (Millican 1981).
- (2) Use the following guidelines for determining when to remove birds from a source population:
 - Source population should have at least 50 turkeys with a stable or increasing trend.
 - Using the minimum population estimate, remove no more than 10% of the hens and 30% of the males in any one year. Up to 15% of the females could be removed in a year following good reproduction, with realization that removals above 10% of the hens may impact the source population slightly (Wakeling and Rogers 1998). Agreement was reached at an interagency meeting in Tucson (11-1-99) that an attempt would be made to translocate turkeys from the Huachuca Mountains to the Galiuro Mountains to enhance that population. This short-term plan calls for moving 10 birds in the winter of 1999-2000, and if at least 3 of those survive until November 2000, the Galiuro population would be supplemented with an additional 10 birds in the winter of 2000-2001. Each group of 10 would contain 2-4 males.

Target sites

- (1) Prioritize southeastern Arizona mountain ranges for sites of future translocations using habitat affinity data developed from radiomarked turkeys in the Galiuro Mountains and Huachuca Mountains, and AGFD turkey habitat scorecard, satellite imagery, and Geographic Information System (GIS) modeling. AGFD's Research Branch should evaluate all southeastern Arizona ranges consistent with habitat affinity data and provide it in GIS format, similar to work already done for pronghorn and bighorn sheep.
- (2) Use the prioritized list of release sites to focus habitat improvement measures and turkey elimination efforts as needed. When possible, habitat projects that are likely to substantially increase success of the translocation should be completed before moving birds; other projects may be initiated as funds and personnel become available.
- (3) Eliminate non-Gould's turkeys from potential range and release sites prior to reestablishment efforts within historical Gould's turkey range. Work with landowners in these same areas to remove or eliminate domestic turkeys and domestic \times wild hybrids before releasing Gould's turkey. Elimination should be accomplished by liberal hunting seasons, with public education to clearly state the intent. Also, baiting and shooting may be used by AGFD personnel. Reported sightings can be investigated and birds eliminated by AGFD personnel. A potential release site will be considered free of turkeys when there are no observations or verified reports in a 24-month period immediately prior to release. During elimination efforts, any birds killed must be reported with detailed location, and specimen material

provided for genetic and other analysis. Any other sightings reported and specimens obtained will be similarly documented and reported to AGFD promptly.

General translocation guidelines

Excellent guidelines have been developed for translocating turkeys, based on decades of success (Swank 1985, Hoffman et al. 1993, Wakeling 1998). The following are the most pertinent:

- Transplants should be conducted in late winter (Jan-Mar).
- If possible, capture source birds from different areas to maximize genetic diversity of founding members.
- Use adults that will be reproductive in the first breeding season.
- Translocate groups of at least 15 birds when establishing new populations; larger groups are preferable.
- Sex ratio of translocated birds 1:1 preferred, 1:2 (M:F) a reasonable objective, 1:4 (M:F) acceptable.
- Do not hold in captivity any longer than necessary (<24 hours preferred).
- Use direct (“hard”) release rather than releasing them first into a holding pen before release into the wild.
- Release before noon or hold overnight so birds have time to locate roosts before dark.
- Ensure target translocation site offers a high probability of success.
- Additional guidelines provided in National Wild Turkey Federation’s Technical Bulletin #3 *Procedures and guidelines for handling and transporting wild turkeys.*≡

Harvest

Turkeys were harvested in the Pinaleno, Chiricahua, Huachuca, Catalina, and Santa Rita mountains soon after those areas received Merriam’s turkey translocations (1939-1950). Spring turkey hunts persisted through the mid-1990s in southeastern Arizona. The last reported harvest in the Chiricahua Mountains was in 1995, with the hunt being discontinued in 1996. The hunt in the Catalina Mountains was discontinued in 1997; the last turkey harvested was in 1994. Currently, there are no turkey tags offered in southeastern Arizona.

In the Huachuca Mountains, no permits were needed to hunt turkeys in the fall prior to 1970. Beginning in 1970, 100 fall permits were authorized until the hunt was closed in 1975, due to a low population. From 1963-74 (12 years), 136 turkeys were harvested by spring and fall hunters combined. A total of 1,966 hunters during this period had a hunt success of 5.2% (O’Brien 1976). The hunt was reinstated in 1980 (5 turkeys harvested), and continued in 1981 (1 turkey harvested) and 1982 (0 turkeys) in an effort to eliminate the remnant population of Merriam’s turkey before Gould’s turkeys were brought in from Mexico in 1983.

The main goal of this plan is to re-establish Gould’s turkeys as a component of the sky island landscape of southeastern Arizona. One of the benefits of that effort would be the reinstatement of regulated hunting. The interest and advocacy of hunters will assure turkey habitat is considered in land management decisions in the coming years. Regulated hunting of males in the spring does not reduce reproductive potential, therefore, it is compatible with concurrent transplants of birds from that same population. Because male turkeys are aggressive and dominate females at preferred feeding sites, males may outcompete female turkeys for

limited food sources, and even reduce female turkey survival, when populations are small. This phenomenon has been described in Wyoming, and generally takes several years to observe a shift in sex ratio towards more male turkeys. Removal of turkeys by both hunting and translocation will be considered by managers in the management of this population.

Strategies:

- (1) Establish a permitted spring season when a population in any mountain range reaches a level that will sustain a limited harvest of one or more males and is also stable or increasing. Any population with at least 50 turkeys should be able to offer removal of a male or two ($50/2 = 25$ males; 2 removed out of $25 = 8\%$ mortality).
- (2) Once a hunt is established, permit adjustments should be made in accordance with hunt guidelines established by AGFD's Turkey Workgroup, as used for all other Arizona turkey populations.
- (3) Special auction tags should be used to raise money for turkey management, however, no tag will be offered for auction unless at least one other tag is available to hunters in the general lottery drawing for big game tags. If only one tag can be offered per year, it should alternate annually between auction and general draw. The first tag available could be auctioned to generate operating funds for habitat work and translocations. Establishing the auction tag will be a simple matter of adding the unit to the list of units available to the special tag holder.

HABITAT MANAGEMENT

The responsibility of habitat management rests with private land owners and the land management agencies in the area. The Arizona Game and Fish Department works cooperatively with these individuals and organizations. Whenever possible, the effectiveness of all habitat modifications to improve turkey habitat quality should be evaluated by monitoring vegetation response or turkey use before and after treatment. Feedback regarding the effectiveness of any habitat improvement will be important in prioritizing future actions.

Prescribed and Natural Burns

Fires were a natural part of the Huachuca Mountain ecosystem before the 1900s. Fires (mostly early May to mid-June) occurred on average of every seven years from 1700-1899 (Danzer 1995). After 1900, widespread fires declined dramatically because of the reduction of fine fuels brought about by heavy livestock grazing, and later because of increasingly effective fire suppression. In later years, fire suppression policies dictated the control of naturally occurring fires.

A thorough habitat evaluation would be the obvious driver for the application of fire to improve turkey habitat quality. Fort Huachuca, in cooperation with the USFS and Bureau of Land Management (BLM), intends to complete a wild fire management plan for the Huachuca Mountains by 2002. There are long-term plans to increase wildland fuel reduction actions on the northeast side of the Huachuca Mountains to reduce fuel density and continuity. If individual prescribed burns are identified as needed on the Fort before the multi-agency wild fire plan is completed, they can be planned and conducted. The Peloncillo Mountains will have a prescribed natural fire plan in place in 2000 and the Chiricahua Mountains should have one in place by

2003.

Areas identified for burns may require funding outside the USFS if it is to be done as a separate project to improve turkey habitat. A more efficient approach is to provide the fire management staff with descriptions of habitats favored by turkeys so these descriptions can be incorporated in their fire plans. The USFS, under interagency agreement, also takes the lead in suppressing wild fires on the Fort above 5,000 feet, in mountainous woodland and forest vegetation. Working with the fire management staff also provides the opportunity to establish reseeding mixtures that are beneficial to turkeys.

Strategies:

- (1) Use habitat affinity data from the radio tagged turkeys in the Huachuca and Galiuro mountains to evaluate other southeastern Arizona turkey ranges. This evaluation should yield areas that will benefit from the application of fire.
- (2) Provide guidance to Fort Huachuca and USFS fire management personnel as to the desired future condition for improvement of turkey habitat. For example, planned burns for fuel reduction should be evaluated with turkey winter nutrition in mind.
- (3) Take into consideration turkey nesting habitat when planning burns during the nesting season (May-June).
- (4) Burns should be used where needed to provide turkey habitat requirements as described by Hoffman et al. (1993) and others. The most important recommendations are:
 - 10-25% of the area should be openings.
 - Smaller opening (2-5 acres) are preferable to larger openings. Long narrow openings should not exceed 240 feet in width. Leave shrubs or trees in middle of openings larger than 10 acres.
 - Retain shrub thickets and tree stands (escape cover) at least 300 feet from the edge of openings (away from openings).
 - Reduce fuel loads downslope of important roost sites and pine stringers. Fires should not be hot enough to burn all downed logs; these structures are important as loafing sites and should be abundant within 50-60 feet of openings.
- (5) Mast producing trees should be protected when possible from burns, as they are crucial to over-winter survival of turkeys.
- (6) Reseeding after burns should be done with turkey needs in mind and based on the draft USFS reseeding guidelines. Seed mixtures selected should be 50% native grasses and 50% forbs with an emphasis on large seeded grasses and legumes (Hoffman et al. 1993). Cattle should be excluded from reseeded areas for two years.

Wood Cutting

Wood cutting permits are issued by Fort Huachuca, which attempts to direct wood cutters to areas in need of thinning to achieve a management goal. The Sierra Vista Ranger District has been using thinning and wood cutting instead of fire to thin woody vegetation in Carr Canyon. A wood cutting project was completed in the Galiuro Mountains to benefit turkeys in 1993. Over 100 acres were cleared in High Creek in a 2-week period.

Areas identified in an evaluation of turkey habitat as being too thick can be provided to USFS staff and Fort Huachuca's forester for consideration when issuing permits. If areas are

identified (e.g., the bottom of McClure Canyon on Fort Huachuca), that may benefit from a reduction in horizontal screening, these projects can be organized and completed as discrete projects specifically for turkeys. These projects provide an excellent opportunity as work projects for volunteer groups, such as the NWTF. Forest openings, which are so crucial to brood rearing, can be created or maintained through directed cuttings of woody vegetation. Ideally, a large-scale evaluation would provide direction as to which areas are the highest priority and offer the best chance for a positive influence on turkey populations.

Strategies:

- (1) Use wood cutting permits and woody vegetation removal projects to create and maintain openings and manage horizontal screening cover using the following guidelines from Hoffman et al. (1993) and others:
 - Brush encroachment can be reversed by clearing brush near the perimeter of openings, however, retain shrub thickets and tree stands (escape cover) at least 300 feet from the openings.
 - 10-25% of the area should be openings.
 - Smaller opening (2-5 acres) are preferable to larger openings. Long narrow openings should not exceed 240 feet in width. Leave shrubs or trees in middle of openings larger than 10 acres.
- (2) Do not remove roost trees or leave large amounts of slash in areas of important roost sites or pine stringers. High fuel loads in these areas may result in hot fires that may remove these crucial trees. Away from roost sites, slash can provide valuable wildlife cover and protection of forbs and grass seedlings.
- (3) If larger trees (>10 inches diameter) are cut, leave some downed logs to be used as loafing sites, especially within 50-60 feet of openings.
- (4) Mast-producing trees should be protected and encouraged by opening the canopy around them, thereby reducing competition.
- (5) Remove excessive woody vegetation around water sources to improve visibility and reduce vulnerability of turkeys. Opening the woody canopy around seeps and springs will also encourage a flush of herbaceous growth. Do not increase horizontal visibility to the point where turkeys cease to use the water source. Optimum screening seems to obscure another human at about 100 feet.
- (6) Limit permits to cut beargrass in areas used by turkeys (Potter 1984):
 - No harvesting of beargrass May and June when plants are flowering and producing seeds.
 - Discourage cutting in July and early August to avoid disturbing young poults.
 - No cutting at all in important brood-rearing areas.
 - Beargrass cuts should be 10 acres or less. If larger cuts are authorized, cutters should leave 30% of the plants uncut within the harvested area.
 - Do not cut plants along drainages that may be used for travel corridors.
- (7) Enforcement of woodcutting guidelines is imperative. Resources must be allocated to allow for spot checks. Violators must be cited.

Planting Mast Seedlings

Mast is an extremely important component of turkey habitat. The availability of mast influences the over-winter survival and physical condition of adult hens, thus the reproductive potential of the population. Population simulations have shown that adult survival has the largest potential to affect turkey population levels (Wakeling and Rogers 1998). The availability of mast is what drives the winter habitat selection of Arizona turkeys. A lack of mast results in lower over-winter survival and reductions in the turkey population.

Mast tree availability may not be a limiting factor. However, if there are cases in which the habitat lacks this component, mast tree saplings can be planted. Only an evaluation of the Huachuca Mountains and other potential target mountain ranges will identify these areas in need of improvement. This is another excellent field project for turkey conservationists. Mast saplings may be procured at local nurseries; some nurseries will grow species that you request. The USFS reseeded guidelines offer some direction in what species are appropriate for various elevations and biotic communities. The NWTF's Wildlife Bulletin #13 (*Regional Recommendations for Planting for Wild Turkeys*) also has useful guidelines. Arizona turkey research also provides abundant information about winter food selection (e.g., Wakeling and Rogers 1995). If mast seedling planting were deemed appropriate, it must be coordinated with the prescribed fire plan as these actions might be counterproductive.

Strategies:

- (1) Use habitat evaluation of the Huachuca Mountains and subsequently other southeastern Arizona ranges to determine the need for mast planting.
- (2) If necessary, contact nurseries and develop a list of sources for native mast tree saplings. The USFS reseeded guidelines and NWTF have a list of contacts.

Grazing Management

There has not been widespread authorized grazing on Fort Huachuca since the 1950s (except for a rental horse pasture). Grazing management is the responsibility of the USFS and BLM on their respective lands. Grass seed heads can be an important source of food for Gould's turkeys in the spring and summer (Potter 1984). Grasses made up 27-35% of the seasonal diet in southwestern New Mexico (York 1991). Grassy meadows or forest openings with abundant herbaceous vegetation are critically important for raising broods. Heavy or poorly timed grazing in this environment can be detrimental to turkey survival and population persistence.

Turkey habitat needs must be considered in allotment management plans to provide brood rearing and nutritional requirements. Levels of livestock use of forage vary across the Forest, but generally range between 30-45% during the summer growing season and 45-55% in the dormant season. Use is measured as percent of annual growth consumed by weight. Use of woody vegetation in riparian areas also varies across the Forest, but is generally between 30-50% on woody vegetation annually. This use level normally represents a frequency count of browsed stems versus the total number of stems within reach of a browsing animal.

Other criteria also apply to use. In identified high density Mearns' quail habitat, livestock are not permitted to use more than 45% of the annual production of the herbaceous forage as measured in weight. Use levels within territories for the Mexican spotted owls and northern

goshawks vary by season, number of years of rest for a pasture, and range condition. Levels range from 0% in pastures in very poor condition that were grazed season-long to 50% in pastures in excellent condition and rested 2 out of 3 years during the growing season (USFS 1998, USFWS 1999).

Wet areas are important to turkeys and the effects of heavy or prolonged livestock use of riparian vegetation can reduce the quality of turkey habitat. Restricting livestock use of these areas will allow riparian vegetation to recover. Much of this is already occurring; riparian areas are being fenced on the Lyle Canyon and Canelo Allotments. Additionally, in designated critical habitat for the Huachuca water umbel, about 50% (or 2 miles) of the wet portions of Bear and Scotia canyons have been or will be fenced to exclude livestock to allow riparian vegetation to recover. In upper Scotia Canyon, a minimum height of 10 to 13 inches for deergrass will be retained annually. Most grazing occurs during December to March and only in years when rainfall is sufficient to provide adequate water for livestock away from the canyons. Fencing projects present an opportunity for turkey conservationists to work with ranchers to improve wildlife habitat.

Strategies:

- (1) Use of herbaceous vegetation should not exceed 50% of annual growth.
- (2) Herbaceous cover in openings less than 5 acres should exceed 70%, with a minimum height of 10 inches (Hoffman et al. 1993).
- (3) Fence half or more of dirt water tank perimeters to allow the growth of herbaceous vegetation. Work with land management agencies and permittees to identify natural springs, seeps, and key stretches of riparian habitat that can be fenced.
- (4) Consider turkey habitat requirements in allotment management plans where turkeys exist or in areas that may serve as a target translocation site. Grazing should be timed to retain herbaceous cover during spring (nesting and brood rearing) and leave adequate seed heads.
- (5) Grazing management should not encourage the use of steep slopes by livestock (e.g., water placement on ridges), as these areas are very important to nesting hens.
- (6) Establish rest-rotation systems on all allotments in current or potential turkey range.

Fertilizing Native Vegetation

There may be situations where fertilizing native vegetation would improve biomass production and benefit turkeys. This technique remains largely untested, but could be experimented with in small openings and grassy benches. This should be tried only with adequate vegetation and turkey use monitoring, so that if there are benefits, they can be demonstrated. This management tool represents a low priority because of problems associated with cost of fertilizer, personnel time needed for vegetation monitoring, and loss of increased biomass to livestock grazing. Despite these hurdles, a small-scale fertilization pilot project may be feasible on a rested pasture or fenced enclosure (i.e., partially fenced dirt tank or riparian area).

Strategies:

- (1) Investigate, on a case-by-case basis, the possibility of adding fertilizer to grassy openings and other critical brood-rearing habitat. This must be done in cooperation with the range staff of

the land management agency to assure coordination with grazing practices.

Wet Meadow Establishment

The establishment of wet areas from natural seeps, springs, run-off, and artificial sources provides great potential for improving turkey habitat in southeastern Arizona. Water seems to be a limiting factor for southwestern turkeys. Wet areas, with resulting vegetation, are much more beneficial than a cement-lined water source. Natural wet areas also benefit a myriad of other wildlife species. One potential difficulty in establishing wet areas for the benefit of turkeys is that the water rights must be taken into account early in planning. Therefore, coordination with permittees and cooperation on their part would be essential.

Both artificial and natural water sources can be used for establishing a wet area. Artificial sources might come from a tapped or leaking water line, windmill overflow, or other water pumping designed for watering livestock. Natural sources include intermittent flow from a side drainage, spring, seeps, and runoff from exposed bedrock.

Regardless of the source of the water, several designs have been developed in recent years to capitalize on water seepage to the benefit of wildlife and their habitat. Gabions have been used successfully by U.S. Fish and Wildlife Service on the Buenos Aires NWR, AGFD, USFS, BLM, and private individuals (e.g., Joe Austin) to slow runoff and create wet areas to benefit wildlife. This management practice is becoming well established as an excellent habitat restoration practice with innumerable benefits. An excellent publication called "Managing Roads for Wet Meadow Ecosystem Recovery" provides guidance for designing and refurbishing drainage culverts under roads to create wet meadows (Zeedyk 1995)

Wet areas (from natural or artificial run-off) on USFS land cannot be planted with non-native plants, however, these areas could be planted with natives to encourage the growth of plants beneficial to turkeys. There is a concern among some plant ecologists that seeds from plants that are collected off-site will have a different genetic makeup, which may dilute the native genes and lower that plant species' fitness. They encourage seeding be done with seeds gathered on site to avoid any unforeseen impacts to genetic integrity.

Strategies:

- (1) Identify potential sites for the establishment of wet meadows from artificial and natural runoff.
- (2) Work with grazing permittee and range staff to determine feasibility of potential sites in regards to water rights.
- (3) Inventory road culverts and determine which can be altered to create wet areas. Prioritize potential sites based on water distribution and potential benefits to turkeys and other species.

Water

A complete inventory of water sources in any mountain range with turkeys or with plans to receive turkeys would be the first step in determining if waters sources are lacking. This would be done in conjunction with a habitat evaluation of southeastern Arizona turkey habitat. An evaluation of water distribution must include a record of permanence rather than simply location. A complete inventory of water sources in the Huachuca Mountains is being conducted by talking to the grazing permittees who are intimately familiar with the location and permanence

of water sources on their allotments. In the meantime, water distribution data from USGS Digital Line Graphs (via the State Land Department) has been mapped and printed with concentric 500-m radii (Figure 1).

This map represents only an estimate of available water, since it undoubtedly is a partial list, contains no information regarding permanence, and also does not show linear stream flow which provides ample water in some areas. This water distribution, then, serves as only a “first-cut” from which to ground truth with the more accurate water inventory underway. This map should help identify areas that are in need of scrutiny or further reconnaissance.

Turkey telemetry locations ($n = 289$) were analyzed in relation to this measure of water distribution. The data indicates Gould’s turkeys in the Huachuca Mountains preferred areas within 1 km (0.6 miles) of a water source and avoided areas farther than 2 km (1.2 miles) from water (Wakeling, AGFD, pers. commun.). Areas >2 km from water and in otherwise suitable habitat should be a high priority for establishing additional water sources. No water sources should be established within 1 km of an existing permanent source. However, wet meadows provide additional benefits and should be encouraged where ever they can be developed.

Strategies:

- (1) Inventory water sources for location, permanence and accessibility.
- (2) Strive to provide permanent water in every square mile of suitable turkey habitat.
- (3) The following guidelines (primarily from Hoffman et al. 1993) should be used when establishing artificial water sources for turkeys.
 - Water sources developed specifically for wildlife should be fenced to exclude livestock.
 - Provide ground-level access.
 - Assure escape cover exists within 100 feet of the water source.
 - Corridors of adequate cover leading to water sites should be preserved.
- (4) Dirt stock tanks should be fenced (or partially fenced) to exclude livestock and a drinker piped off to the side for use by cattle.
- (5) Ramps should be installed on above-ground water tanks where ever needed to allow access for poults and escape ramps.
- (6) Investigate the feasibility of lining dirt tanks to improve water retention.

OTHER MANAGEMENT OPTIONS

Supplemental Feeding

Supplemental feeding is one management option that is frequently discussed for many species. This involves the offering of some type of feed, rather than the planting of food plots discussed below. In general, the reported problems associated with this activity are: inability to affect the nutritional intake of a sufficient percentage of the population, lack of positive response in reproduction or survival even for the animals receiving the supplement, supplement may not provide all nutrients necessary for that species or may actually be detrimental, presence of toxins (e.g., Aflatoxin), and it artificially concentrates animals, predisposing them to predation, disease, and poaching. Supplemental feeding also fosters a protectionist attitude among humans and can contribute to a lack of wildness in turkeys (Hoffman et al. 1993). For this reason, the AManagement Guidelines for Merriam’s Turkeys” reports *The general consensus among wild turkey biologists is that supplemental feeding does not enhance survival nor reproductive*

performance of wild turkeys under normal winter conditions.

The interest in supplemental feeding is usually to improve survival or reproduction. Beasom and Pattie (1979) reported an increase in the number of hens reproducing when a population was supplementally fed a commercial ration in South Texas. Because it is rare for turkeys in the Southwest to nest in their first year, it would be beneficial if additional nutrition enabled yearling hens to reproduce. Wakeling and Rogers (1998) concluded that yearling hen reproduction was the single factor that presented the greatest potential for improvement. They recommended efforts to improve the nutrition of yearling female turkeys and, hence, their propensity to nest.

It is conceivable that an intensive feeding program could increase the reproductive output of the Huachuca population, but the habitat would have to be able to support any additional birds recruited. Theoretically, there may also be a place for supplemental feeding in winter in the case of a mast crop failure, if it could be determined when a failure occurred in most or all the major mast-producing species.

There are additional restrictions on supplemental feeding on USFS land. For example, supplemental feed is not allowed in wilderness areas, only native seeds would be allowed (i.e., no corn or milo) on all USFS land, and wild and domestic animals on these allotments would quickly find the feed sites and obliterate them.

One option used in the Rocky Mountain region involves rolled bales of mature wheat or barley placed on tripods and fenced to reduce deer and cattle depredation. This provided feed throughout a lengthy period of time with minimal maintenance required. Additional research may elucidate some conditions where it would benefit turkeys in an intensive management situation such as the Huachuca Mountains.

Strategies:

- 1.) Supplemental feeding should be investigated by comparing reproductive indices of yearling hens exposed to supplemental feed (such as in Ramsey Canyon) versus those on native foods. This management action may have value in intensive management situations such as the Huachuca Mountains for increasing overall reproduction, especially following a documented mast crop failure in almost all important mast sources.

Food Plots

Some of the same problems inherent in supplemental feeding are also pertinent to food plots, such as higher vulnerability of concentrated birds, inconsistent or untested population benefits, and loss to non-target species. Despite their widespread use in the management of bobwhite quail, actual benefits in terms of higher quail densities are questionable (Guthery 1997). On the other hand, if several food plots were available to a small population of turkeys, they may increase the nutritional level enough to improve reproduction or survival. Turkeys in the Southwest are probably more apt to be limited nutritionally than turkeys in other parts of the United States.

Food plots are, however, much more difficult to establish in arid regions. Without irrigation, food plots are not feasible in most canyons and mountain ranges of the arid Southwest.

Opportunities are few for using existing irrigated land to benefit turkeys. Possibilities of locating irrigable land for turkey food plots exist above the Sunnyside townsite, Miller Canyon, Korn Canyon, and Ramsey Canyon. Wet areas (from natural or artificial run-off) on USFS land cannot be planted with non-native plants, however, these areas could be planted with native plants as mentioned above under “Wet Meadow Establishment.” Landowners should be encouraged to plant native vegetation and improve habitat conditions which would benefit turkeys and other wildlife species.

Strategies:

- 1.) Locate possible sites on private land with access to irrigation for planting food plots.
Develop Stewardship Agreement with landowner.

Predator Control

Predator control has not been shown to increase turkey populations (Hoffman et al. 1993). Birds released into the Galiuro Mountains scattered widely throughout the whole mountain range, and as a result, predator control would have to suppress the coyote and bobcat populations significantly on a landscape scale to be effective (Wakeling 1998). The main problem lies in effecting a significant reduction (in both intensity and area) in predator numbers using the methods currently available. Computer population modeling shows that reducing the coyote population by 75% each year would still require 50 years to remove the coyotes (Connolly and Longhurst 1975). The goal is never to remove all the coyotes in predator management, but this illustrates the resistance and resiliency of coyote populations. We cannot control predators over an area as large as a game management unit at the intensity researchers do in a 1-mi² fenced research area. Traps are illegal on public land in Arizona and poisons are illegal everywhere. Aerial gunning is not practical in most turkey habitat, and many areas are not suitable to predator hunting because of rough and remote terrain. Sporadic removal of coyotes and bobcats by hunters has been shown to be ineffective in reducing predator populations sufficiently to reduce predation rates.

Strategies:

- (1) In light of the lack of a demonstrated benefit to turkey populations, predator control is not a cost effective management tool, and money should be directed to more productive projects, such as long-term habitat improvement and acquisition.

FUNDING

Many potential sources of funding available to provide for habitat management or research for Gould’s turkeys.

- (1) About \$2,000 is currently available from the AGFD special tag sales. The amount available on an annual basis is variable.
- (2) The NWTF has funds available for habitat improvements, specifically the “Guzzlers for Gobblers” program for water developments (\$1,500 per development, maximum 3 per state).
- (3) The Arizona Chapter and the Sierra Vista Chapter of NWTF have money available from their banquet fund raisers, estimated to be about \$25,000 per year (M. Adkins, pers. commun.).
- (4) Funds could be generated by offering hunt permits in the Huachuca Mountains when the

population is sufficient to do so. One tag could be auctioned (Special Tag) to generate the first ever legal Gould's turkey hunt in the United States. This could raise several thousand dollars for Gould's turkey management and research.

- (5) There may be additional special funding from the NWTF for studies on subjects such as supplemental feeding of southwestern turkeys.
- (6) Habitat improvement projects, such as wet meadows and fencing stock tanks, could be submitted as a Heritage Proposal, or cost-shared with other organizations, such as Ducks Unlimited or The Nature Conservancy -- benefiting several game and many nongame species.
- (7) Certain projects may qualify for funding under the USFS or AGFD Stewardship Programs.
- (8) Wet meadows may be funded with the Water Protection Fund.
- (9) Additional money may be available for wet meadow establishment if it benefits endangered plant resources.

RESEARCH NEEDS

The primary research need, upon completion of existing studies, is to identify and prioritize future transplant sites based on existing information. The ongoing work in the Huachuca and Galiuro mountains should provide a mathematical model for identifying suitable habitats. To supplement that model, detailed information on microsite characteristics used for specific behaviors, such as nesting and roosting, would further help identify suitable habitats. The maintenance of radio-marked birds is important to identify habitat characteristics used for nesting and roosting and to aid in determining recruitment through resighting birds. Other topics of interest and direct applicability to management include the propensity for yearling hens to nest and factors that influence that propensity, population estimation, genetic disposition of turkeys that inhabit other mountains and riparian areas, the influence of land management practices on habitat affinity-use and documenting the effects of supplemental feeding on population demographics

LITERATURE CITED

- AGFD 1961. Turkey survey instructions: route descriptions and procedures. Arizona Game & Fish Department, Phoenix. W-53-R-11.
- Beasom, S. L., and O. H. Pattie. 1979. Supplemental feeding to increase wild turkey productivity. *Journal of Wildlife Management* 43:512-516.
- Connolly, G. E., and W. M. Longhurst. 1975. The effects of control on coyote populations: a simulation model, University of California – Davis, Division of Agriculture Scientific Bulletin Number 1872. 37pp.
- Danzer, S. 1995. Huachuca Mountain fire history. Unpublished progress report, Laboratory of tree-ring research, University of Arizona, Tucson. 11pp.
- Emory W. H. 1848. Notes of a military reconnaissance, First edition, Washington D. C. 613pp.
- Engel-Wilson, R. 1997. Turkey transplants in Arizona. *Arizona Wildlife Views*. May issue.
- Guthery, F. S. 1997. A philosophy of habitat management for northern bobwhites. *Journal of Wildlife Management* 61:291-301.
- Hoffman, R. W., H. G. Shaw, M. A. Rumble, B. F. Wakeling, C. M. Mollohan, S. D. Schemnitz, R. Engel-Wilson, and D. A. Hengel. 1993. Management guidelines for Merriam's wild

- turkeys. Colorado Division of Wildlife Report number 18. 24pp.
- Kenamer, J. E., and M. C. Kenamer. 1996. Status and distribution of the wild turkey in 1994. Pages 203-212 in J. G. Dickson ed. Proceedings of the seventh National wild turkey symposium. National Wild Turkey Federation and Stackpole Books, Mechanicsburg, PA.
- Leopold, A. S. 1959. Wildlife of Mexico: the game birds and mammals, University of California Press, Berkeley. 568pp.
- Millican, J. 1981. Region V turkey performance report. Arizona Game & Fish Department, Phoenix, W-53-R-31, WP2, J1.
- Mock, K. E., T. C. Theimer, and P. Keim. 1999. Genetic differentiation among subspecies of wild turkey (*Meleagris gallopavo*): Preliminary results relevant to the Ft. Huachuca population. Report to the Arizona Game and Fish Department. 5pp.
- O'Brien, P. 1976. Unit 35A turkey performance report. Arizona Game & Fish Department, Phoenix, W-53-M.
- Olding, R. J. 1982. Region V turkey performance report. Arizona Game & Fish Department, Phoenix, W-53-M, WP2, J1.
- Potter, T. D. 1984. Status and ecology of Gould's turkey in New Mexico. Master's Thesis, New Mexico State University, Las Cruces. 104pp.
- Rea, A. M. 1980. Late Pleistocene and Holocene turkeys in the Southwest. Contributions to the Science and Natural History Museum, Los Angeles County. 330:209-224.
- Stangel, P. W., P. L. Leberg, and J. I. Smith. 1992. Systematics and population genetics. Pages 18-28 in J. G. Dickson ed. The Wild Turkey: Biology and Management. Stackpole Books, Harrisburg, PA. 463pp.
- U.S. Fish and Wildlife Service. 1999. Biological opinion. On-going and long-term grazing on the Coronado National Forest. Arizona Ecological Services Field Office. Phoenix, Arizona. AESO/SE 2-21-98-F-399.
- U.S. Forest Service. 1998. Biological assessment of on-going and long-term grazing on the Coronado National Forest. U.S.D.A., Forest Service, Southwestern Region. Albuquerque, New Mexico.
- Wakeling, B. F. 1998. Survival of Gould's turkey transplanted into the Galiuro Mountains, Arizona. Pages 227-234 in Proceedings of the ninth U.S./Mexico Border States Conference on Recreation, Parks, and Wildlife. Proceedings PMRS-P-5.
- Wakeling, B. F., and Rogers T. D. 1998. Characteristics of Pinon-Juniper habitats selected for feeding by wintering Merriam's turkey. Pages 74-79 in D. W. Shaw, E. F. Aldon, and C. LoSapio, technical coordinators. Desired future conditions for pinon-juniper ecosystems. U.S. Forest Service General Technical Report. RM-258.
- Wakeling, B. F., and Rogers T. D. 1998. Summer resource selection and yearling survival of male Merriam's Turkeys in north-central Arizona, associated implications from demographic modeling. Arizona Game & Fish Department Technical Report 28, Phoenix. 50pp.
- York, D. L. 1991. Habitat use, diet, movements, and home range of Gould's turkey in the Peloncillo Mountains, New Mexico. Master's Thesis, New Mexico State University, Las Cruces. 104pp.
- Zeedyk, W. 1996. Managing roads for wet meadow ecosystem recovery. United States Department of the Interior, U. S. Forest Service, Southwestern Region. Technical

Publication FHWA-FLP-96-016.

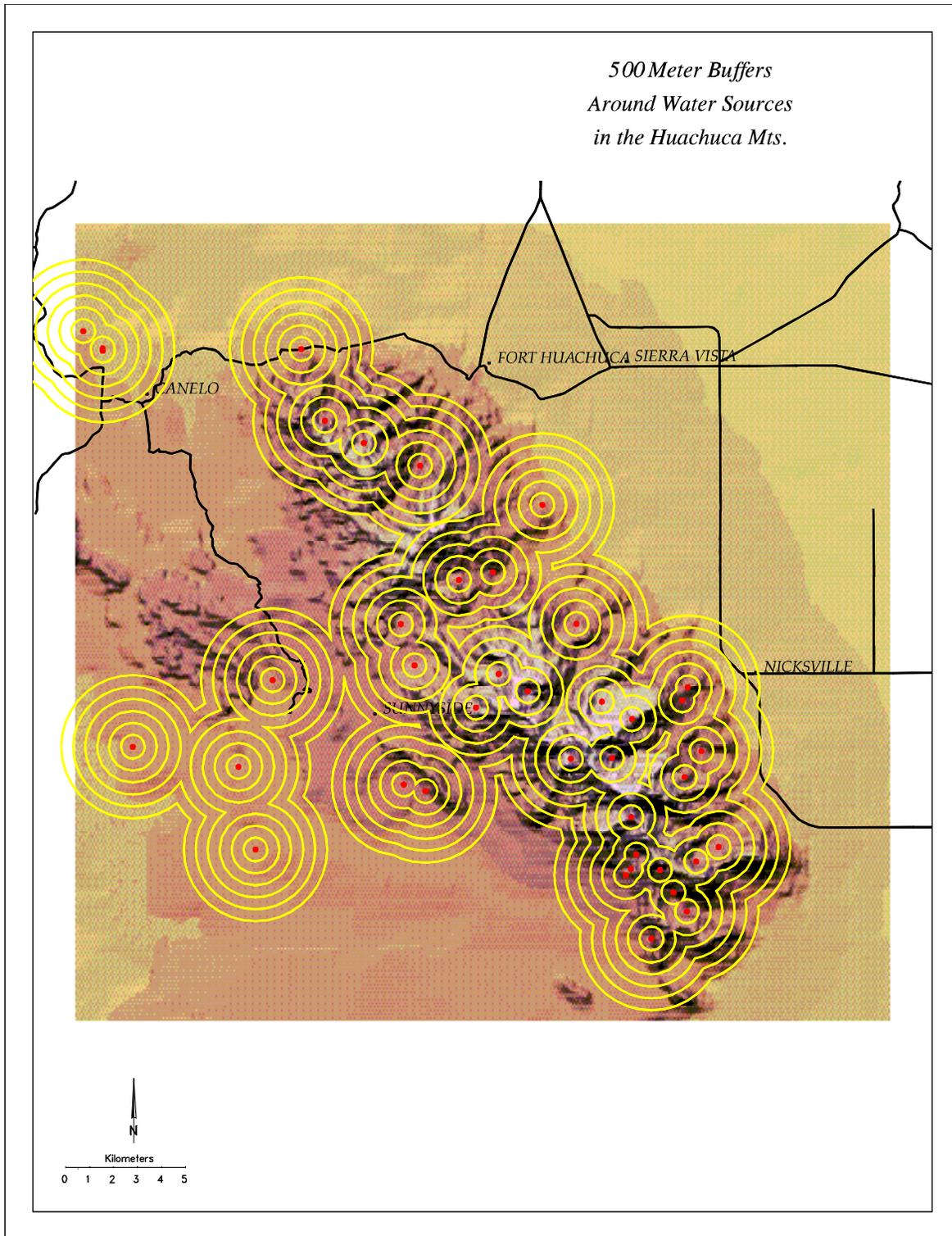


Figure 1. Water distribution in the Huachuca Mountains with concentric rings with 500-m radii.