

WYOMING TOAD RECOVERY PLAN



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WYOMING TOAD RECOVERY PLAN

Prepared by

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for

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U.S. Fish and Wildlife Service
Denver, Colorado

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EXECUTIVE SUMMARY

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

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

Recovery Objectives: Downlisting

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

Actions Needed: Major actions needed to achieve recovery include:

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

Total Cost of Recovery: Total recovery costs from all involved agencies are estimated at \$1.6 million.

Date of Recovery: Downlisting to threatened should be initiated in 2000 if recovery criteria are met. These objectives should be met with implementation of the recovery plan. As the recovery plan is implemented and refined, an objective for delisting (including delisting criteria) will be developed. It is anticipated that delisting could be achieved by 2005.

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PART I

INTRODUCTION

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

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

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

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

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

Description

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

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

Bufo hemiophrys

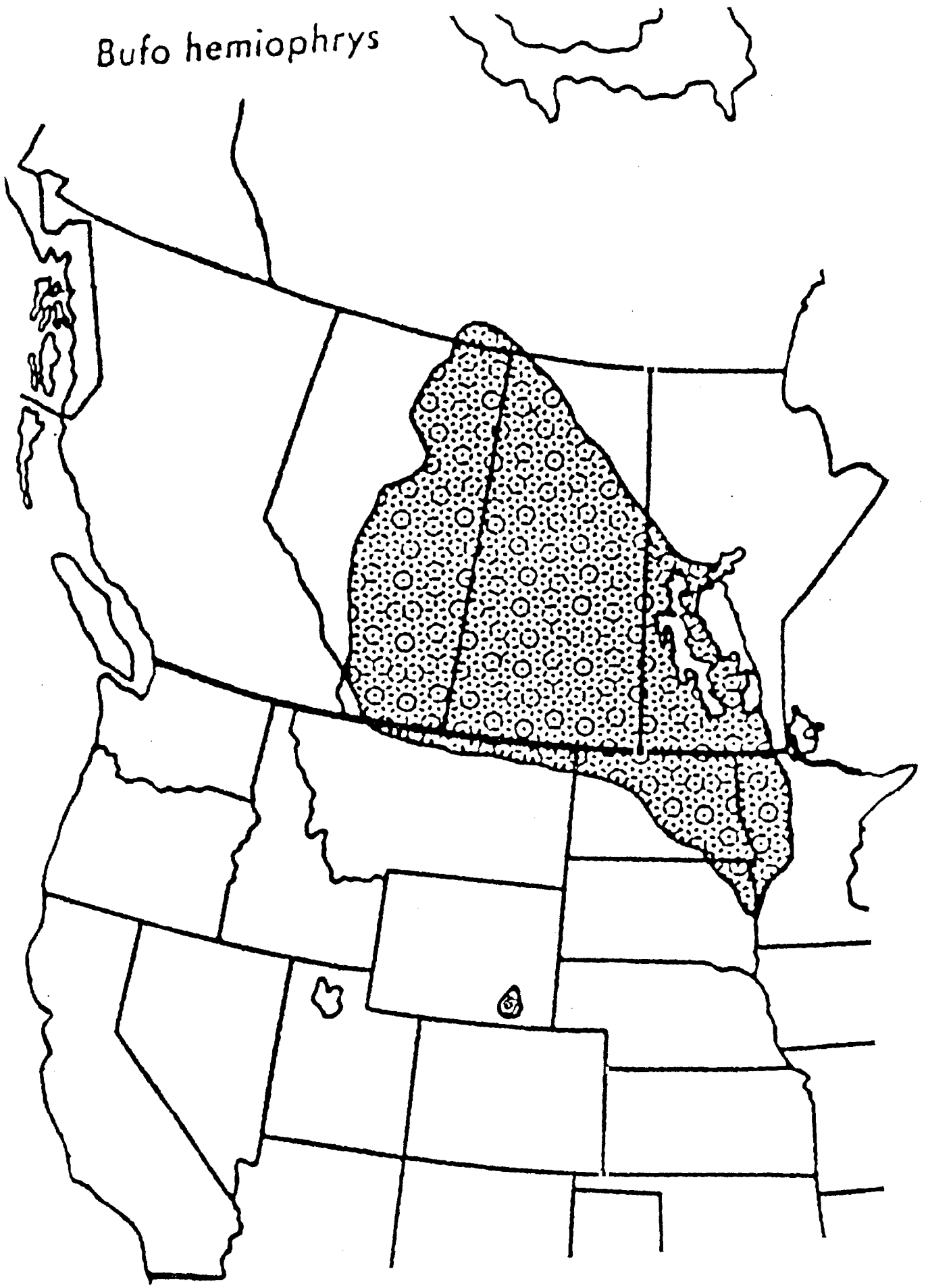


Figure 1. Bufo hemiophrys distribution (from Stebbins 1984).

WYOMING

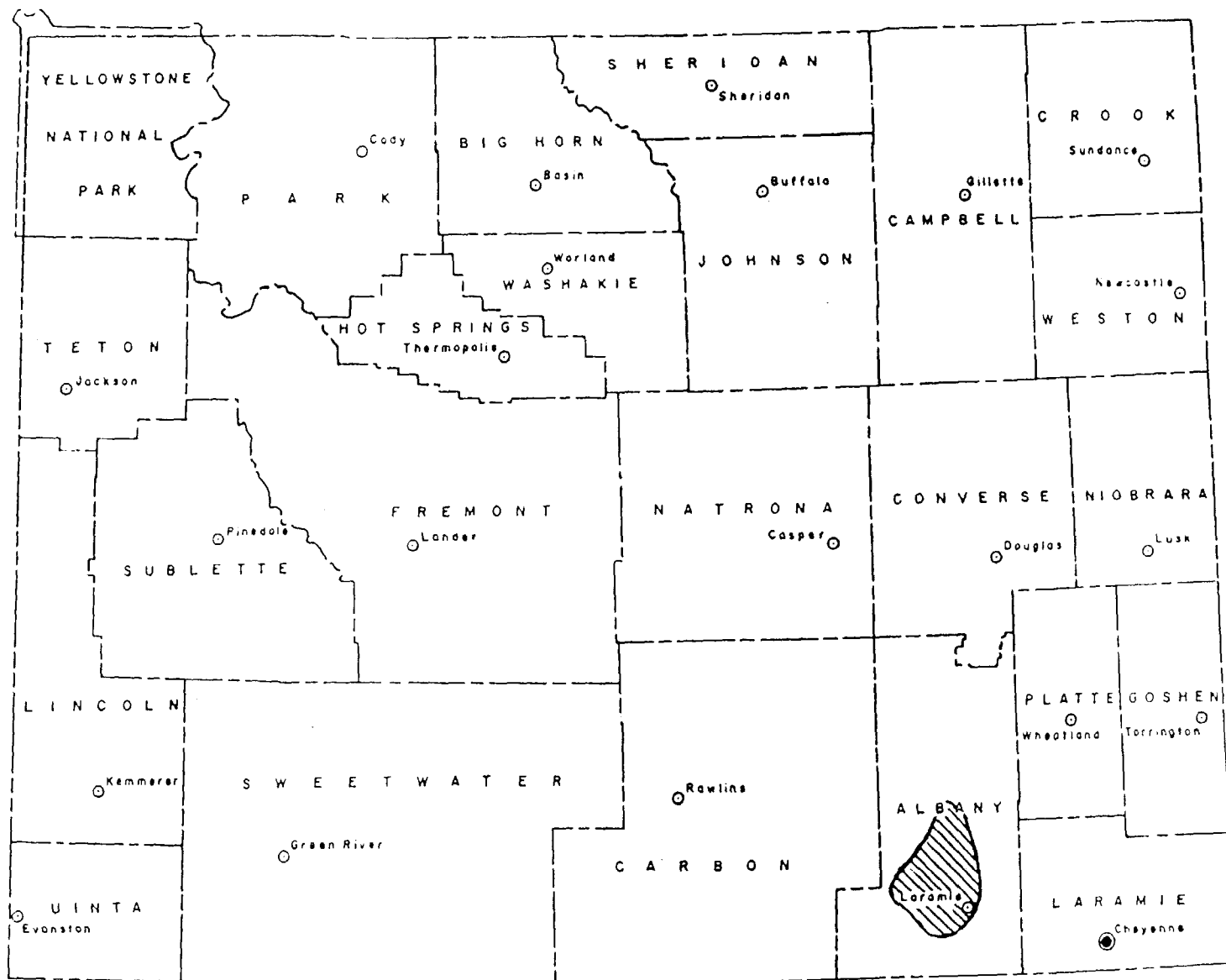


Figure 2. Wyoming map depicting Wyoming toad distribution.
(Baxter and Stromberg 1985)

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

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

Taxonomy

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

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

Distribution

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

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

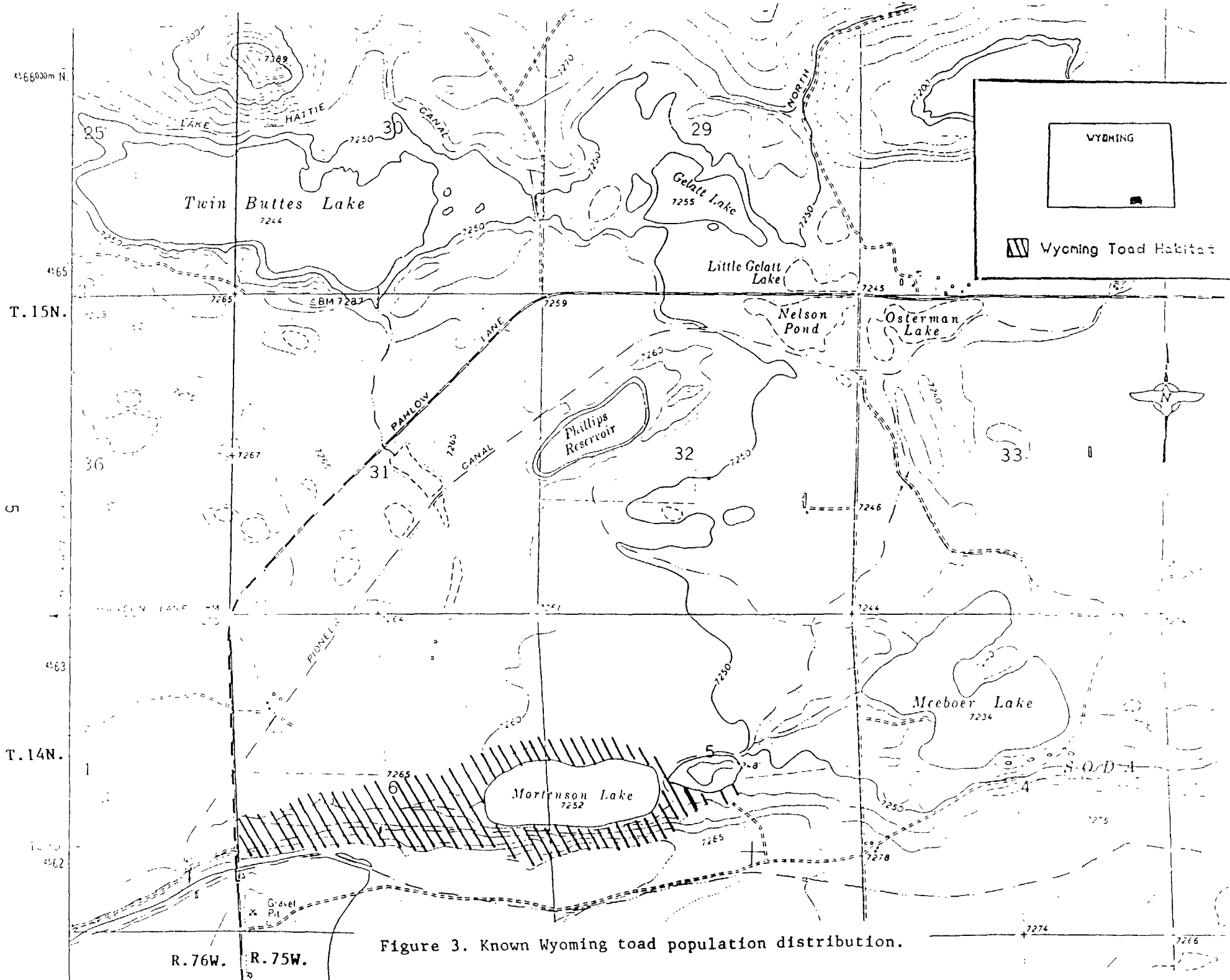


Figure 3. Known Wyoming toad population distribution.

Life History/Ecology

Reproduction: Breeding occurs in shallow water typically less than 6 inches deep. Vegetated margins and bays of lakes, ponds, and irrigated meadows are preferred breeding areas. Breeding sites are often dry by late summer.

Adult toads appear at breeding sites in May after daytime temperatures reach 70° F. Males appear first and attract females with their calls. Breeding congregations are not large, usually consisting of a half dozen males and a few females gathering at a pond or lake margins. Breeding takes place from mid-May to mid-June depending upon weather conditions in any given year. Eggs are deposited in gelatinous strings containing 2,000 to 5,000 heavily pigmented (black) eggs. Egg strands are often intertwined among vegetation. This contrasts with the eggs of frogs (genus Rana) which are laid in masses or clusters.

Water temperatures during incubation were recorded in 1988. Temperatures reached 77° F during the daytime but dropped to 50° F during the night at sites where eggs hatched with excellent success. Eggs hatched in less than 1 week at these temperatures. Tadpoles transformed into toadlets by 4 to 6 weeks following egg deposition.

Food Habits: Wyoming toad diets include ants, beetles, and a variety of other arthropods (Baxter and Stone 1985). Observations indicate that active foraging is not restricted to the night in the early summer. Nocturnal habits are displayed by adults at times during the dry part of late summer.

Habitat: Wyoming toads inhabit floodplains, ponds, and the margins of small seepage lakes in the shortgrass communities of the Laramie Basin. Shallow seepage lakes resulted from wind erosion during prehistoric dry periods when many blowout basins and sand dunes were found. The Laramie Basin is apparently too dry for the boreal toad, and too cold for the Great Plains toad and Woodhouse's toad (Bufo woodhousei woodhousei Girard) that occur on the plains in eastern Wyoming (Baxter and Stone 1985). At elevations of 7,000 to 7,500 feet, the semiarid intermontane Laramie Basin is characterized by short grasses and sagebrush. Vegetative cover provides important protection from summer evaporation. Numerous small seepage lakes, river courses, and impoundments for delivery of irrigation water provide the moist areas essential to toad survival.

Reason for Listing

From the 1940's through the early 1970's, the Wyoming toad was abundant throughout its limited range. Rapid declines were observed in the mid-1970's. By the late 1970's, the Wyoming toad had become extremely rare. During the early 1980's, only a few individuals were observed. A single healthy population of approximately 100 to 150 adults was located in 1987. Surveys in 1988 revealed that this population contains good numbers of individuals from several age classes and is capable of natural reproduction. However, since 1989 reproduction has not been able to maintain populations levels. The once common Wyoming toad experienced a drastic population decrease in a relatively

short time and is now extremely rare (Table 1). Reasons for the decline in Wyoming toad abundance have been the subject of much speculation but little resolution.

Pesticides were suspected as a cause for the decline. Widespread aerial spraying of fenthion (trade name Baytex) for mosquito control coincided with population declines. Because toxicity and bioaccumulation have been demonstrated in other amphibian larvae, this was strongly suspected. Preliminary evaluations with leopard frog (Rana pipiens Schreber) and boreal toad larvae yielded 96-hour LC50 estimates considerably higher than expected field concentrations (Lewis et al. 1985). Bioassays conducted on the Manitoba toad (closest living relative of the Wyoming toad) in 1988 confirmed that neither Baytex nor the diesel carrier is toxic to Wyoming toad eggs and larvae at expected field concentrations. This research did not address indirect or long-term effects of this pesticide, which could still pose a threat to the survival of this species.

Predation also was identified as a possible threat to toad populations. Increases in California gulls, white pelicans, and mammals such as raccoons parallel the toad decline. Significant predation by animals from fish, birds, or mammals has not been documented. Toads are generally distasteful and somewhat toxic. Field observations in 1988 failed to document serious predation on either breeding adults or young toads. Some insect predation on eggs and tadpoles is expected.

Nationwide declines in amphibians have occurred in recent years, many from unknown causes. Populations in some areas have recovered while some have not. Locally, leopard frogs and boreal toads have declined as well. Natural population cycles are not well understood; however, disease could be a factor. Diseases, such as the bacterial infection red leg, have been associated with leopard frog declines in Wisconsin (Hine et al. 1981). Red leg was confirmed in 1990 by Dr. Elizabeth S. Williams, Wyoming State Veterinary Laboratory, University of Wyoming (personal communication), within the wild population, which resulted in mortality.

Habitat modification through changes in irrigation and haying practices surfaced as a potential contributor to declining toad populations. Major habitat changes are not evident and the amount of suitable wet areas in the Laramie Basin greatly exceeds that of 100 years ago. However, the extent and quality of floodplain wetlands, where the toad formerly resided, have been reduced.

Changes in weather patterns, in the form of a series of late, cold springs, may result in successive years of reproductive failure. Additional investigation is needed to determine whether such weather conditions have indeed occurred. Furthermore, the relatively short duration of temperature records prevents accurate comparisons with historical conditions, such as the past 2,000 years.

Table 1. Changes in Wyoming toad relative abundance. Note that survey intensity and methods were not directly comparable between years.

Date	Abundance
1950's-1970	Common throughout range (Baxter and Stromberg 1980)
Mid-1970's	Rapid population decline
1976-1978	Extremely rare (Baxter and Stromberg 1980)
1979	No toads located (Stromberg 1981)
1980	One population of approximately 25 toads located (Vankirk 1980)
1981	One male and one female at 1980 site
1982	No toads calling
1983	Two juvenile toads located in intensive survey
1984	Approximately 30 males located in intensive survey
1985	No toads found
1986	No toads found
1987	Single, healthy population located
1988	Population located in 1987 maintaining at approximately 100 to 150 adults
1989	Population located in 1987 declining to approximately 100 to 125 adults, and reproduction poor
1990	Population located in 1987 declining to approximately 100 adults; reproduction low and adult mortality caused by red leg bacteria

Genetic defects, drift, or homogeneity in small populations can contribute to extinction. From the late 1970's through 1986, the lack of substantial reproduction hinted that this might be a factor. Documentation of poor reproduction in 1989 and 1990 makes this a continued concern.

Heavy metals, soil and water conditions, and pollution have been suggested as potential contributors to declining toad populations but evidence has not developed to implicate any of these possibilities. Additional effort is needed to pinpoint the causes for declines in Wyoming toad populations.

Conservation Measures

The Wyoming Toad Recovery Group (Recovery Group) was formed in 1987 to coordinate protective, research, and recovery efforts. Emphasis by the Recovery Group has been centered primarily on protecting and monitoring the existing population, searching for additional populations, protecting and maintaining habitat, establishing a captive population, protecting and identifying limiting factors. Research programs have been instituted with the University of Wyoming, the Service's National Ecology Research Center, and the Wyoming Cooperative Fish and Wildlife Research Unit. Recently, a graduate student has been selected to assist in research studies. Measures to protect the existing Wyoming toad population have been coordinated by the Wyoming Game and Fish Department and the Service with local landowners. A protection plan has been coordinated with the local mosquito control district to safeguard known toad habitat from potential adverse effects from pesticides. The Nature Conservancy has recently acquired the majority of the existing toad habitat at Mortenson Lake and has been instrumental in the establishment of a conservation easement with another adjacent landowner. A captive-rearing program has been initiated at the Wyoming Game and Fish Department's Sybille Wildlife Research Unit. As of June 1991, 16 toads are in captivity. Television public service announcements and newspaper articles have been released to increase public awareness and appreciation of the toad recovery effort. The Wyoming Toad Recovery Management Team (Recovery Management Team) consisting of representatives of the Service and the Wyoming Game and Fish Department has been established to coordinate implementation of recovery tasks. The Recovery Group will act as a consultant to the Recovery Management Team providing it with up-to-date biological information and technical advice.

PART II
RECOVERY

Objectives and Criteria

Preventing extinction of the Wyoming toad is the primary objective. Actions that must be taken to prevent extinction or to prevent the species from declining irreversible in the foreseeable future are denoted by an "*" in the narrative outline that follows. Downlisting to threatened status is a secondary objective that can occur when (a) the threat of extinction has been eliminated, (b) quantifiable goals have been established to define a biologically stable, secure population, (c) the existing population has been demonstrated to be stable and secure with approximately 150 adults, and (d) five new secure populations of approximately 100 adults each have been established or located in the Laramie Basin. These objectives should be met with implementation of the recovery plan. As the recovery plan is implemented and refined, an objective for delisting (including delisting criteria) will be developed.

Outline for Recovery Actions Addressing Threats

Step-down Outline

- *1.0 Maintain current populations and habitat of the Wyoming toad.
 - *1.1 Monitor populations and habitat.
 - *1.11 Monitor existing populations and habitat.
 - *1.12 Survey and monitor additional populations and habitat.
 - *1.2 Protect and enhance existing populations and habitats.
 - *1.21 Move toads/eggs in immediate threat to safety (e.g., desiccating eggs).
 - *1.22 Attain habitat protection and enhancement through property rights acquisition or conservation easement.
 - 1.23 Work cooperatively with landowners.
 - 1.231 Encourage favorable land use practices.
 - 1.232 Implement protective measures.
 - 1.233 Implement enhancement measures.
 - 1.234 Compensate landowners for income loss from protective and enhancement measures.

1.235 Acknowledge landowner cooperation.

*2.0 Conduct research.

2.1 Refine general life history knowledge.

*2.2 Identify limiting factors.

2.3 Improve monitoring techniques.

2.4 Determine taxonomic status of the Wyoming toad.

2.41 Identify taxonomic evaluation needs.

2.42 Evaluate taxonomic status.

2.5 Develop delisting criteria.

*3.0 Maintain Wyoming toads in captivity to ensure against catastrophic loss of the wild population.

*3.1 Determine numbers of Wyoming toads desired in captivity.

*3.2 Determine location(s) for captive rearing.

*3.3 Captively rear Wyoming toads.

4.0 Reestablish Wyoming toad populations within historical range.

4.1 Identify and prioritize suitable reintroduction sites.

4.2 Secure habitat and population safety in candidate sites.

4.3 Develop transplant protocol.

4.4 Transplant surplus individuals.

4.5 Monitor status of reintroductions to determine reasons for success or failure.

4.6 Manage restored populations and habitats.

5.0 Eliminate threats/habitat degradation.

5.1 Review and comment on projects affecting Wyoming toads.

5.2 Enforce existing laws and regulations protecting the Wyoming toad.

5.3 Inform appropriate agencies of their responsibilities to protect endangered species.

- 5.4 Ensure Endangered Species Act Section 7 compliance.
- 5.5 Promote public awareness to increase appreciation and cooperation.
- *6.0 Establish organizational arrangements to accomplish tasks and increase communication.
 - *6.1 Form a management team comprised of representatives from the Wyoming Game and Fish Department and U.S. Fish and Wildlife Service.
 - 6.2 Maintain the working group in an advisory capacity.
- *7.0 Develop funding sources to implement recovery.

Narrative Outline

- *1.0 Maintain current populations and habitat of the Wyoming toad.

Preventing extinction of the Wyoming toad is the primary recovery objective. Protection of the only known population at Mortenson Lake is critical to prevent extinction of the species. Maintenance of current populations and habitat represents the starting point for recovery. Recovery will be impossible unless this population, or genetic reserves from this population, is maintained. If other populations are found in the future, they also will need protection.

- *1.1 Monitor populations and habitat.

Monitoring populations and habitat is necessary to determine if recovery objectives are being met and whether species status is improving or worsening. Normal population variation for a healthy population is unknown. Research should be directed toward life history and habitat features that will help improve monitoring techniques. Recent photography techniques, utilized to identify individual toads by their wart patterns, have greatly assisted in estimating population abundance and expanding species knowledge. This technique shows great promise and will be used in 1991 to standardize survey methods. As more knowledge of the toad's life history is gained, monitoring techniques will be further refined.

- *1.11 Monitor existing populations and habitat.

Relative abundance of existing populations should be monitored annually. Surveys for calling males should be conducted during May and early June. Egg masses should be located and counted in late May and early June. Egg and tadpole development and toadlets should be monitored throughout the summer. The entire population should be surveyed in late summer, around September 1 prior to

hibernation. Incidental to the above monitoring, data will be collected when applicable on important habitat components, weather, and soil and water conditions.

*1.12 Survey and monitor additional populations and habitat.

Surveys of other potential habitats in the Laramie Basin (springs, ponds, lakes, floodplain areas, etc.) will be conducted through at least 1992 as conditions permit. Additional populations can be most effectively located and monitored by listening for calls in late May or early June. Surveys should begin as soon as toads are heard calling at Mortenson Lake, generally around mid-May. As more is learned about habitat requirements, surveys should expand to areas of similar habitat. Presently the most promising habitats appear to be within the floodplains of the Little and Big Laramie Rivers and other freshwater lakes similar to Mortenson Lake.

*1.2 Protect and enhance existing populations and habitats.

With only one known population, protection of it and its habitat is vital to this species' recovery. Without public ownership, long-term protection of the existing toad population and habitat is not guaranteed. Public ownership of the habitat also will allow for maximum implementation of management programs and habitat enhancement necessary to accomplish recovery of the toad. Projects to enhance this habitat should be developed and implemented to provide additional recovery opportunity to expand the existing population. Increasing egg and larvae survivorship also is needed to facilitate the maintenance and expansion of the existing population and recovery efforts.

*1.21 Move toads/eggs in immediate threat to safety (e.g., desiccating eggs).

Moving eggs that would otherwise desiccate to permanent water is one of the better protective measures available. Approximately 33 percent of the eggs laid in 1988 would have died without transfer to permanent water. This protective measure should be implemented annually as needed in conjunction with egg mass monitoring.

*1.22 Attain habitat protection and enhancement through property rights acquisition or conservation easement.

Acquisition of Mortenson Lake, including water rights and surrounding habitats, would protect nearly all of the known habitat. This acquisition is vital to prevent the extinction of the Wyoming toad and to increase the potential

for species' recovery. The Nature Conservancy has recently acquired the majority of these property rights. The Service is currently investigating opportunities and has initiated procedures to obtain funding to acquire this property from The Nature Conservancy and possibly some other adjacent lands. Acquisition by the Federal Government will further ensure protection of this habitat and allow for management of the Wyoming toad through the National Wildlife Refuge Program. Future land acquisitions or conservation easements also may be needed to protect additional populations if found, or to provide suitable habitat areas for the purpose of reintroduction.

1.23 Work cooperatively with landowners.

Protection of existing and future toad populations and habitat on private land can only occur with landowner cooperation. Because the majority of the former habitat for the species occurred on private lands, it is essential for its recovery that good landowner relations be established and maintained.

1.231 Encourage favorable land use practices.

Work should continue to identify both favorable and unfavorable land use practices with respect to the toad. Favorable land use measures, such as the use of biological mosquito control measures, delayed or deferred haying, and exclusion of summer grazing in areas where toads are present should be encouraged. Encouragement in some instances may include technical, manpower, and financial assistance through conservation easements or compensation for income loss.

1.232 Implement protective measures.

Mosquito control assistance has been given to avoid the use of potentially damaging chemicals. Bacterial control agents (i.e., BTI) are encouraged in lieu of chemical treatment. Other protective measures include fencing areas to preclude livestock use and deferring or delaying haying of areas known to contain toads. If these latter measures are implemented on private lands, landowners should be compensated for income loss.

1.233 Implement enhancement measures.

Several specific enhancement measures have been identified. Water level management in Mortenson Lake

to enhance toad survival and reproduction in dry years is planned. Wetland enhancements to create open water habitat within sedge/rush marshes are another possibility. Placement of buffering devices to reduce wave action along shorelines to encourage emergent marsh development could possibly enhance toad breeding/rearing areas. More enhancement opportunities will likely be apparent when more is known about life history and habitat requirements of the Wyoming toad.

1.234 Compensate landowners for income loss from protective and enhancement measures.

Landowners should not be expected to incur major income losses to implement protective or enhancement measures for the recovery of the species. Past compensation has been provided to implement alternate mosquito control methods and preclude livestock grazing and hay cutting in certain areas. Planning efforts should continue to identify key protective and enhancement measures and compensate private landowners (e.g., conservation easements) in an equitable manner when private lands are involved.

1.235 Acknowledge landowner cooperation.

Acknowledgment of landowner cooperation is an important aspect of continued cooperation. Verbal and written acknowledgments have been expressed to date and should continue in the future. Public acknowledgment should be pursued for participating landowners. The previous private landowners of Mortenson Lake and adjacent property were recently awarded the Outstanding Contribution to Wildlife Award for 1990 by the Service. Public acknowledgement also can come in the form of newspaper or magazine articles, conservation awards, and personnel recognition by the Recovery Group.

*2.0 Conduct research.

Only general life history, habitat needs, and limiting factors are known. Lack of detailed life history and habitat information inhibits recovery actions. Research is needed to obtain this information. Additional work on taxonomic relationships and on monitoring procedures also is needed.

2.1 Refine general life history knowledge.

Studies are needed to determine seasonal movements of the various life stages. Fecundity and reproductive frequency information is

needed. Life span and age at maturity have not been precisely determined. Hibernation habits and habitats also are unknown. Habitat use at Mortenson Lake should be quantified, including soils, moisture, vegetation, and other pertinent features. Study plans have been developed to obtain information on life history, habitat needs, and limiting factors in a manner that is not detrimental to the existing toad population. These plans will need to be expanded upon and updated as needed by the Recovery Management Team (identified in Task 6.1) with the assistance of the Recovery Group.

*2.2 Identify limiting factors.

Identification of limiting factors is one of the most important aspects of recovery. Several reasons for declining toad populations have been proposed. Studies to date have discounted some suspected causes, but they have failed to positively identify any causes. Additional research is needed to identify and verify limiting factors, especially overwintering habitat needs. Long, harsh winters in the Laramie Basin make good overwintering habitat essential to all amphibians in this area. Several theories exist about overwintering habitats for the Wyoming toad; however, no hibernation data exists. Research is needed to determine what habitats are important to toad overwintering and the abundance and conditions of these habitats within the toad's historic range.

2.3 Improve monitoring techniques.

As more knowledge of the toad's life history is gained, improved monitoring techniques can be developed. Research should be directed toward life history and habitat features that will help improve monitoring techniques.

2.4 Determine taxonomic status of the Wyoming toad.

Taxonomic status of the Wyoming toad is unclear. Work is needed to determine if this toad should be recognized as a full species or a subspecies. Regardless of the taxonomic uncertainty, classification as endangered is appropriate. Full species, however, are given higher priority and emphasis under the Endangered Species Act.

2.41 Identify taxonomic evaluation needs.

Research should be outlined that will resolve taxonomic questions in an efficient, nonlethal manner. Toads in the wild or vital to the recovery or captive rearing efforts should not be sacrificed for taxonomic evaluations.

2.42 Evaluate taxonomic status.

Once research needs are determined, studies to evaluate taxonomic status should be conducted.

2.5 Develop delisting criteria.

As the recovery plan is implemented and refined, delisting criteria will be developed. The Recovery Management Team (identified in Task 6.1), with the assistance of the Recovery Group, will develop the delisting criteria prior to downlisting of the species to threatened.

*3.0 Maintain Wyoming toads in captivity to ensure against catastrophic loss of the wild population.

Captive rearing is needed to provide genetic reserves in the event of a catastrophe at the only known remaining population. Captive rearing also will help preserve genetic diversity and enhance future management options. Genetic reserves should be maintained until the recovery objectives are met. The number of toads removed from the wild should be severely limited to only eggs, young-of-the-year toads, and adults obviously incapable of surviving in the wild.

*3.1 Determine numbers of Wyoming toads desired in captivity.

Preliminary work has identified an eventual target of 100 to 200 toads with an equal sex ratio. Refinement of this target may be needed as better information becomes available on the wild and captive populations. Captive rearing should start with smaller numbers until culture techniques are mastered. A maximum of 24 toads was targeted for the initial startup of the captive rearing program.

*3.2 Determine location(s) for captive rearing.

Potential locations for captive rearing were reviewed by the Service and the Wyoming Game and Fish Department. Evaluation factors included long-term commitment, technical capability, reliability, and safety. The Wyoming Game and Fish Department's Sybille Wildlife Research and Conservation Education Unit was selected as the site for initial captive rearing. An additional captive rearing location should be selected to receive toads once sufficient numbers have been successfully reared at Sybille. Preliminary discussions with zoo curators have indicated that some zoos may meet the criteria for a secondary rearing location. To facilitate the success of the captive rearing program the American Association of Zoological Parks and Aquariums Species Survival Plan should be evaluated.

*3.3 Captively rear Wyoming toads.

Wyoming Game and Fish Department personnel visited facilities at the Houston Zoo in 1989 and discussed rearing techniques with personnel involved with the captive rearing program for the endangered Houston toad. Contacts also were made with people

experienced in amphibian culture in the United States and other countries. Facilities needs and rearing techniques were determined based on this information.

There were 12 toads taken into captivity at Sybille in September 1989, and 16 in September of 1990. As of June 1991, 16 toads are in captivity. Captive rearing techniques continue to be refined based on experiences with these toads. The Recovery Management Team should continue to refine both captive rearing targets and approaches.

4.0 Reestablish Wyoming toad populations within historical range.

Additional populations must be established to achieve recovery. The long-range goal is to establish at least 5 additional populations of 100 breeding individuals within their former range. Reintroduction will need to be initiated as a means of establishing new populations. Many amphibian reintroduction attempts have been unsuccessful and there are divergent opinions among experts on the likelihood of success. However, sufficient encouragement has been received from some experts to pursue reintroductions with the caveat that reintroduction efforts will be done in a manner that does not jeopardize toads in the wild. Repeated reintroductions will be needed to establish new populations.

4.1 Identify and prioritize suitable reintroduction sites.

To maximize chances of success, only the most suitable reintroduction sites should be used. Ability to determine suitable sites will improve as habitat needs and life history features are documented in the future.

Several potential reintroduction sites within the historical range have been evaluated. Of these, the most promising is Lake George on the Hutton Lake National Wildlife Refuge, because of its historical population, land status, ability to control water levels, and land management practices. Additional work is needed to systematically identify and prioritize other reintroduction sites. Potential sites are located within the Big and Little Laramie Rivers floodplains and several other lakes in the basin that have similar characteristics to Mortenson Lake. Information from proposed life history and habitat research (item 2.0) is needed before other areas can be adequately prioritized. In addition, further coordination and landowner approval is needed prior to any reintroductions.

4.2 Secure habitat and population safety in candidate sites.

Habitat and population safety are secured for Lake George, the primary candidate site, through its location on the Hutton Lake National Wildlife Refuge. Work is needed to secure habitat and population safety on the other candidate sites before making reintroductions there.

4.3 Develop transplant protocol.

Transplants of surplus individuals for reintroductions have been planned according to the numbers of egg masses available. Initial transplant protocol prohibits transplants if only one egg mass is available. When five or more egg masses are available, transplants will be made in a manner that maximizes genetic diversity. Further protocol refinement is needed, including research to determine optimum stocking schedules and whether any life stages other than eggs should be stocked. Amphibians have strong homing behavior, and any adult moved from an area, most likely, will simply attempt to move back. Thus, transplanting efforts will primarily utilize eggs or tadpoles.

4.4 Transplant surplus individuals.

Transplants of surplus individuals for reintroductions will be made in accordance with transplant protocol (item 4.3) and in areas identified through the section process (item 4.11). Prior to any reintroduction, landowner approval will be obtained and further coordination with potentially affected individuals or entities conducted.

4.5 Monitor status of reintroductions to determine reasons for success or failure.

Reintroductions should be monitored annually with the approaches outlined in section 1.1. With additional life history and habitat information, improved monitoring techniques should result in better assessments of reintroduction success or failure. Long-term survival of a self-sustaining population is required for a reintroduction to be considered successful.

4.6 Manage restored populations and habitats.

Specific population and habitat management needs should be identified as reintroductions become established. Schedules and budgets should be developed by the Recovery Management Team.

5.0 Eliminate threats/habitat degradation.

Land management practices and projects implemented within the historic range of this toad that have the potential to adversely affect toad populations and habitat need to be minimized or eliminated.

5.1 Review and comment on projects affecting Wyoming toads.

All Federal actions potentially affecting the Wyoming toad should be reviewed by the Service and the Wyoming Game and Fish Department and recommendations provided to applicable agencies for their consideration in order to avoid adverse impacts to the species.

5.2 Enforce existing laws and regulations protecting the Wyoming toad.

Important safeguards by Federal and State laws are provided to ensure the protection of the Wyoming toad from malice acts. The species is protected by the Federal Endangered Species Act and Wyoming State law. The Service and other Federal Agencies are responsible for ensuring compliance with Federal laws and regulations. The Wyoming Game and Fish Department is responsible for enforcing State law.

5.3 Inform appropriate agencies of their responsibilities to protect endangered species.

The Service should keep State and Federal agencies, enforcement personnel, and the public informed of their responsibilities regarding the laws protecting listed species and their habitats. Agency and enforcement personnel should receive status updates and notification of the enforcement concerns for this toad.

5.4 Ensure Endangered Species Act Section 7 compliance.

All Federal Agencies need to ensure that they comply with Section 7 of the Endangered Species Act in their construction, funding, or permitting projects that may affect toad populations or habitat. The Service should periodically notify applicable Agencies (Bureau of Land Management, Soil Conservation Service, Environmental Protection Agency, and Animal and Plant Health Inspection Service) of the need for Section 7 compliance to prevent inadvertent violations. Assistance to these Agencies through informal consultation will be provided on request.

5.5 Promote public awareness to increase appreciation and cooperation.

Public awareness and appreciation for the toad are important to both agency and public support for recovery. Public experience with amphibians in Wyoming is extremely limited, as is appreciation for programs to manage these species. Efforts are needed to increase public awareness and appreciation for toad recovery efforts. Television public service announcements and newspaper articles have been released and should be continued to help inform the public and generate positive response. Additional, organized public awareness programs should be developed. This may include organizing trips to known or potential toad habitats for local schools, interested citizens, and conservation or professional organizations. The Service and the Wyoming Game and Fish Department will share joint responsibility for coordinating such efforts. Field trips will only be conducted if proper protection of the Wyoming toad and its habitat can be maintained.

- *6.0 Establish organizational arrangements to accomplish tasks and increase communication.

Specific organizational arrangements are needed to effectively meet the diverse challenges facing recovery of the species, including establishment of a recovery management team and maintaining the existing Recovery Group to orchestrate various recovery tasks.

- *6.1 Form a management team comprised of representatives from the Wyoming Game and Fish Department and the Service.

The Service has responsibility for protection and management of federally listed species. The Wyoming Game and Fish Department has responsibility for management of wildlife in Wyoming. Therefore, a management team comprised of representatives from these agencies has been established. Policy and management responsibilities should be coordinated annually to achieve recovery for the Wyoming toad.

- 6.2 Maintain the Recovery Group in an advisory capacity.

The Recovery Group was established in 1987 to help with initial direction and provide input to recovery efforts. This group consists of representatives from the Service, Wyoming Game and Fish Department, University of Wyoming, The Nature Conservancy, and other interested individuals. This group contributed greatly to the progress to date. This group should be more formally recognized, expanded as needed, and its function be advisory to the Recovery Management Team.

- *7.0 Develop funding sources to implement recovery.

Funding proposals should be developed by the Recovery Management Team for identified recovery tasks and should be submitted to appropriate Federal, State, and private entities for their consideration. Additional funding sources should be developed as needed.

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PART III
IMPLEMENTATION SCHEDULE

Funding of the recovery program until the species is recovered and delisted is essential. Costs outlined in the following implementation schedule are estimated annual costs for implementing each task. They are not meant to represent costs to a specific agency or program. However, the basic principle of this recovery program is that protection and recovery are a cooperative responsibility.

Definition of Priorities

Priority 1 - An action that must be taken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future.

Priority 2 - An action 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 objectives.

Abbreviations Used in Implementation Schedule

APHIS	Animal and Plant Health Inspection Service
FWE	U.S. Fish and Wildlife Service--Fish and Wildlife Enhancement
NERC	U.S. Fish and Wildlife Service--National Ecology Research Center
LE	U.S. Fish and Wildlife Service--Law Enforcement
RE	U.S. Fish and Wildlife Service--Realty
RW	U.S. Fish and Wildlife Service--Refuges and Wildlife
BLM	Bureau of Land Management
EPA	Environmental Protection Agency
SCS	Soil Conservation Service
WCoop	Wyoming Cooperative Fish and Wildlife Research Unit
WGFD	Wyoming Game and Fish Department
TNC	The Nature Conservancy
ongoing	Ongoing--task/action will be required over a very long or undetermined period of time

RECOVERY PLAN IMPLEMENTATION SCHEDULE

PRIORITY	TASK #	TASK DESCRIPTION	DURATION (YEARS)	Reg	RESPONSIBLE PARTY		COST ESTIMATES				COMMENTS	
					Program	Other	FY92	FY93	FY94	FUTURE YRS		
1	1.11	Monitor existing populations & habitat	ongoing	6	FWE WCoop	WGFD	4,000	4,000	4,000	60,000		
1	1.12	Surveys additional populations	ongoing	6	FWE/NERC W Coop	WGFD	10,000	6,000	6,000	52,000	Other agency assistance is encouraged, i.e., BLM, EPA, SCS	
	1.21	Move toads/eggs from immediate threats	ongoing	6	FWE W Coop	WGFD	1,000	1,000	1,000	13,000		
1	1.22	Protect habitat through land acquisition	ongoing	6	FWE/RE	WGFD TNC	420,000	125,000	125,000	-	Federal land trades & obtaining conservation easements could reduce this amount	
25	1	2.2	Identify limiting factors	5	6	FWE/NERC WCoop	WGFD	15,000	10,000	10,000	10,000	
1	3.1	Determine numbers needed in captivity	1	6	FWE/NERC W Coop	WGFD	1,000	-	-	-		
1	3.2	Determine rearing locations	1	6	FWE	WGFD	-	-	-	-		
1	3.3	Captively rear toads	ongoing	6	FWE	WGFD	10,000	5,000	5,000	70,000		
1	6.1	Form management team	completed	6	FWE	WGFD	-	-	-	-		
1	7.0	Develop funding sources	ongoing	6	FWE	WGFD	500	500	500	6,500		
2	1.231	Encourage favorable land practices	ongoing	6	FWE	WGFD, SCS APHIS, BLM	2,000	2,000	2,000	20,000		

RECOVERY PLAN IMPLEMENTATION SCHEDULE

PRIORITY	TASK #	TASK DESCRIPTION	DURATION (YEARS)	Reg	RESPONSIBLE PARTY		COST ESTIMATES				COMMENTS	
					Program	Other	FY92	FY93	FY94	FUTURE YRS		
2	4.6	Manage introduced populations	ongoing	6	FWE/RW	WGFD TNC BLM	1,000	5,000	5,000	60,000		
2	5.2	Enforce laws and regulations	ongoing	6	FWE/LE	WGFD BLM, EPA, SCS	1,000	1,000	1,000	13,000		
2	5.3	Inform agencies	ongoing	6	FWE	WGFD	1,000	1,000	1,000	5,000		
2	5.4	Ensure Section 7	ongoing	6	FWE	BLM, EPA, SCS APHIS	4,000	4,000	4,000	40,000		
27	2	5.5	Promote public awareness & cooperation	ongoing	6	FWE	WGFD BLM, SCS	5,000	5,000	5,000	26,000	
2	6.2	Maintain working groups	ongoing	6	FWE	WGFD	2,000	2,000	2,000	15,000		
3	2.41	Identify taxonomic needs	1	6	FWE/NERC	WGFD	1,000	-	-	-		
3	2.42	Evaluate taxonomic status	2	6	FWE	WGFD WCoop	-	10,000	5,000	-	Research unit to be selected	
3	5.1	Consultation and comment on projects	ongoing	6	FWE	WGFD BLM, SCS EPA, APHIS	5,000	5,000	5,000	60,000		

RECOVERY PLAN IMPLEMENTATION SCHEDULE

PRIORITY	TASK #	TASK DESCRIPTION	DURATION (YEARS)	Reg	RESPONSIBLE PARTY		COST ESTIMATES				COMMENTS
					Program	Other	FY92	FY93	FY94	FUTURE YRS	
2	1.232	Implement protective measures	ongoing	6	FWE	WGFD, BLM APHIS	2,000	2,000	2,000	20,000	Costs included in 1.231
2	1.233	Implement enhancement measures	ongoing	6	FWE	WGFD, SCS	2,000	2,000	2,000	20,000	
2	1.234	Compensate landowners	ongoing	6	FWE		2,000	2,000	2,000	20,000	
2	1.235	Acknowledge coop.	ongoing	6	FWE	WGFD	1,000	1,000	1,000	5,000	
2	2.1	Refine life history information	ongoing	6	FWE/NERC	WGFD	20,000	15,000	15,000	20,000	
2	2.3	Improve techniques	ongoing	6	FWE/NERC	WGFD	1,000	1,000	1,000	5,000	
2	2.5	Develop delisting criteria	ongoing	6	FWE	WGFD	-	-	-	2,000	
2	4.1	Determine reintroduction sites	2	6	FWE/RW	WGFD	10,000	2,000	-	-	
2	4.2	Secure candidate sites	5	6	FWE	WGFD	10,000	10,000	5,000	10,000	
2	4.3	Develop transplant protocol	5	6	FWE/NERC	WGFD	5,000	2,000	1,000	2,000	
2	4.4	Transplant toad	5	6	FWE	WGFD	1,000	1,000	1,000	2,000	
2	4.5	Monitor introduction	ongoing	6	FWE/NERC	WGFD	4,000	4,000	4,000	52,000	

APPENDIX

This recovery plan was made available to the public for comment as required by the 1988 amendments to the Endangered Species Act of 1973. The public comment period was announced in the Federal Register (56 F.R. 11567) on March 19, 1991, and closed on May 3, 1991. Six press releases were sent to the print media located in State of Wyoming.

During the public comment period, 22 letters were received. The comments provided in these letters have been considered and incorporated as appropriate. Comments addressing recovery tasks that are the responsibility of an agency other than the U.S. Fish and Wildlife Service have been sent to that agency as required by the 1988 amendments to the Endangered Species Act.