

Boreal Toad (*Bufo boreas boreas*) Recovery Plan

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Photo by Stephen Corn

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Table of Contents

1.0 INTRODUCTION	3
2.0 BACKGROUND	3
2.1 NATURAL HISTORY	4
2.1.1 Taxonomy	4
2.1.2 Description	4
2.1.3 Distribution.....	4
2.1.4 Required Habitats.....	8
2.1.5 Food Habits.....	8
2.1.6 Reproductive Biology	8
2.1.7 Growth and Longevity	9
2.1.8 Movement	9
2.1.9 Predators, Competitors, and Diseases	9
2.2 HISTORICAL PERSPECTIVE.....	10
2.2.1 Habitat Trends.....	10
2.2.2 Population Trends	10
2.2.3 Use and Demand Trends	10
2.2.4 Past Management	11
2.3 HABITAT ASSESSMENT.....	11
2.3.1 Status	11
2.4 ECONOMIC AND SOCIAL IMPACTS	11
2.4.1 Economic Profile.....	11
2.4.2 Economic Use of Habitat.....	12
2.4.3 Sociological Factors.....	12
3.0 MANAGEMENT STRATEGY	12
3.1 MANAGEMENT GOAL AND OBJECTIVE	12
3.2 MANAGEMENT ISSUES AND STRATEGIES	12
3.2.1 Issue 1-Need for Current Distribution Information.....	12
3.2.2 Issue 2-Need for Information on Biology and Natural History of the Boreal Toad	13
3.2.3 Issue 3-Need for Information on Threats to New Mexico Populations.....	13
3.2.4 Issue 4-Management issues	13
4.0 IMPLEMENTATION SCHEDULE	15
4.1 IMPLEMENTATION SCHEDULE TASKS	15
4.1.1 Improve and maintain knowledge of status of the Boreal Toad.....	15
4.1.2 Improve and maintain knowledge of the biology of the Boreal Toad.....	15
4.1.3 Develop and maintain high levels of cooperation and coordination between stakeholders and interested parties	15
4.1.4 Improve and maintain knowledge of potential threats to the Boreal Toad.....	16
4.2 IMPLEMENTATION SCHEDULE TIME-LINE	16
5.0 LITERATURE CITED	19
6.0 APPROVALS	23
7.1 HISTORY OF PUBLIC PARTICIPATION	24
7.2 LISTING OF INTERESTED PARTIES AND MEMBERS OF ADVISORY COMMITTEE	25

List of Figures

Figure 1. Distribution of the Western Toad, *Bufo boreas*.



Figure 2. Potential Distribution of the Boreal Toad in New Mexico (Painter and Pierce 2000, unpublished report).

Figure 3. Typical habitat at Lagunitas Lakes in Rio Arriba County, New Mexico.

Figures 4a & 4b. Participants of May 24th 2006 meeting in Chama, NM, to formulate management section for the Recovery Plan for the Boreal Toad (*Bufo boreas boreas*): Chuck Hayes (NMDGF), Tina Jackson (CO DOW), Ken Boykin (NMSU), and Jose Carrillo, Jr. (EMNRD), Leland Pierce (NMDGF). Not pictured: Craig Fetkavich (Private Citizen).

1.0 Introduction

This is a Recovery Plan for the Boreal Toad (*Bufo boreas boreas*), developed under the authority of the New Mexico Wildlife Conservation Act (WCA). The New Mexico Department of Game and Fish (NMDGF) is directed under the WCA to develop recovery plans for species listed as threatened or endangered by the State [17-2-40.1 NMSA 1978]. Each recovery plan is to have the following components:

- a strategy to restore and maintain viable populations of the listed species and its habitat, to the extent that the species may be downlisted
- a strategy that mitigates adverse social or economic impacts resulting from recovery actions
- a strategy to identify social or economic benefits and opportunities
- a strategy to use existing resources and funding to implement the overall Recovery Plan.

As directed by the WCA, a public information meeting was held December 12, 2005, in Chama, New Mexico at the initiation of the process, and an Advisory Committee was formed to help develop the Recovery Plan. Members of the Advisory Committee met on May 24, 2006, in Chama, New Mexico, to formulate the management section of the Recovery Plan. See Appendix 5.2 for a list of committee members. Parts of this document are based upon the *Conservation Plan and Agreement for the Management and Recovery of the southern Rocky Mountain population of the Boreal Toad* (Loeffler 2001).

The organization of this Recovery Plan follows Graves (2002). Section 2 includes background information on the natural history, historical perspective, habitat assessment, and potential economic and social impacts of this Plan. Section 3 contains the goal for the recovery of the Boreal Toad, accompanying objectives, and the issues affecting the recovery of the species and the strategies for addressing those issues. Section 4 provides a suggested time-line for implementation of the plan.

2.0 Background

Section 2.0 contains information on the distribution, status, habitat requirements, biology, and ecology of the Boreal Toad. The section also includes economic and social profiles of the region within the range of the species in New Mexico. This information provides the basis for assessing current status, threats to persistence, and the most effective strategies for the recovery of the species. Note that the use of "Boreal Toad" in the Recovery Plan refers to the southern Rocky Mountain population refers to the subspecies *Bufo boreas boreas*, of which includes the range of the subspecies in New Mexico.



2.1 NATURAL HISTORY

2.1.1 Taxonomy

The Western Toad (*Bufo boreas*), is a member of the family Bufonidae, with three nominal subspecies, only one of which, the Boreal Toad (*Bufo b. boreas*), occurs in New Mexico (Crother et al. 2000, Degenhardt et al. 1996). The Boreal Toad was first described by Baird and Girard (1852). Goebel (1996) conducted genetic research on mitochondrial DNA that indicates the southern Rocky Mountain populations of *B. b. boreas* may be a separate species, and Hammerson (1999) suggested the more proper common name should be “Mountain Toad”, leaving the “Boreal” designation for populations in northwestern North America.

Note that the Recovery Plan follows the nomenclature of “Boreal Toad” proposed by Crother et al. (2000).

2.1.2 Description

The Boreal Toad is a dark brown to black toad, with many large warts, particularly along the dorsal surface of the tibia (Degenhardt et al. 1996). Cranial crests are either lacking or only faintly evident, and the Boreal Toad has a distinct whitish middorsal stripe. The middorsal stripe may be broken into segments and is usually lacking in juvenile toads. The paratoid gland is oval in shape and is 1-1.5 the length of the upper eyelid. The venter is buff or whitish, with many dark spots on the chest. Adult male Boreal Toads range in length from 60-80 mm (2.4-3.1 in) snout to vent (SVL), while females range from 75-100 mm (2.9-3.9 in) SVL (Loeffler 2001).

Boreal Toad tadpoles are blackish with little or no iridescence, with the underside slightly paler (Degenhardt et al. 1996). The muscular aspect of the tail is black with cloudy fins of equal height (dorsal and ventral), while the spiracle is on the left side of the body near the middle. The labial tooth row formula is 2/3. Degenhardt et al. (1996) provide a key to the tadpoles of New Mexico. Toadlets are similar in appearance to adults, except for often lacking the middorsal stripe and possessing red-orange coloration on the toes (Stebbins 2003).

2.1.3 Distribution

Historic. Western toads occurred throughout much of the western North America (Lannoo 2005). The Boreal Toad (*Bufo boreas boreas*) occurs in New Mexico, Colorado, and Wyoming in populations disjunct from the rest of the species range, as well as from Wyoming and Nevada to the Pacific Coast, then up through Alaska. The California Toad (*B. b. halophilus*) occurs along the western side of North America, from Baja California to southern Oregon. The Amargosa Toad (*B. b. nelsoni*) occurs only in the Amargosa River drainage in southwestern Nevada. NMDGF and the University of New Mexico staff developed a potential distribution for the Boreal Toad in New Mexico, based upon known locations for the species, elevation, and potential habitat (Painter and Pierce 2000, unpublished report; see also Section 2.1.4, Required Habitats). While no records exist for the species in New Mexico prior to 1966, it is likely the historic range of the Boreal Toad fell within suitable habitat found in the proposed distribution (Figure 2). See Lannoo (2005) for a discussion of the historic range of the Western Toad.



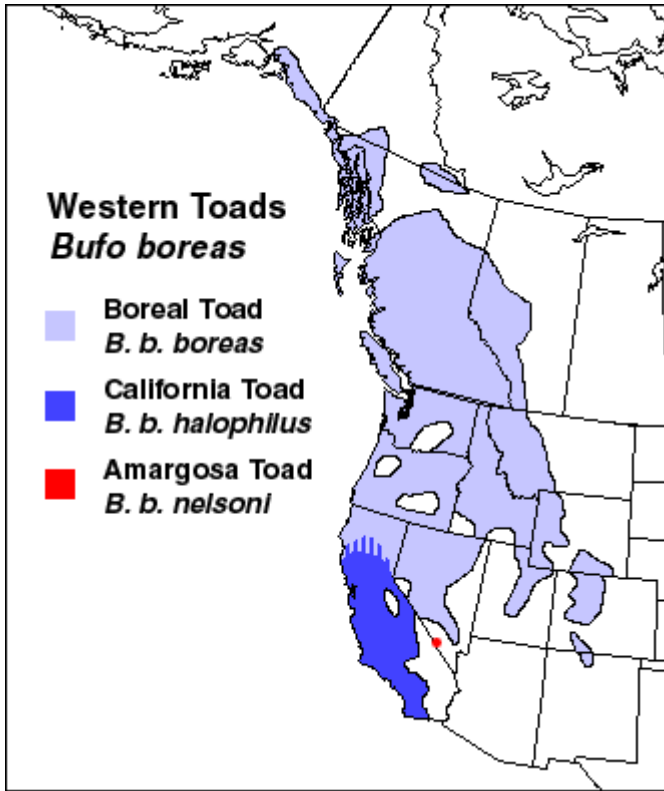


Figure 1. Distribution of the Western Toad, *Bufo boreas*. From USGS, Northern Prairie Wildlife Research Center, <http://www.npwrc.usgs.gov/>

Current. The Western Toad is currently found from southern Alaska south to northern Baja California, and from the Rocky Mountains west to the Pacific Ocean (Stebbins 2003, Figure 1). The species extends at least as far south as Baja California Norte in Mexico (Grismer 2002).



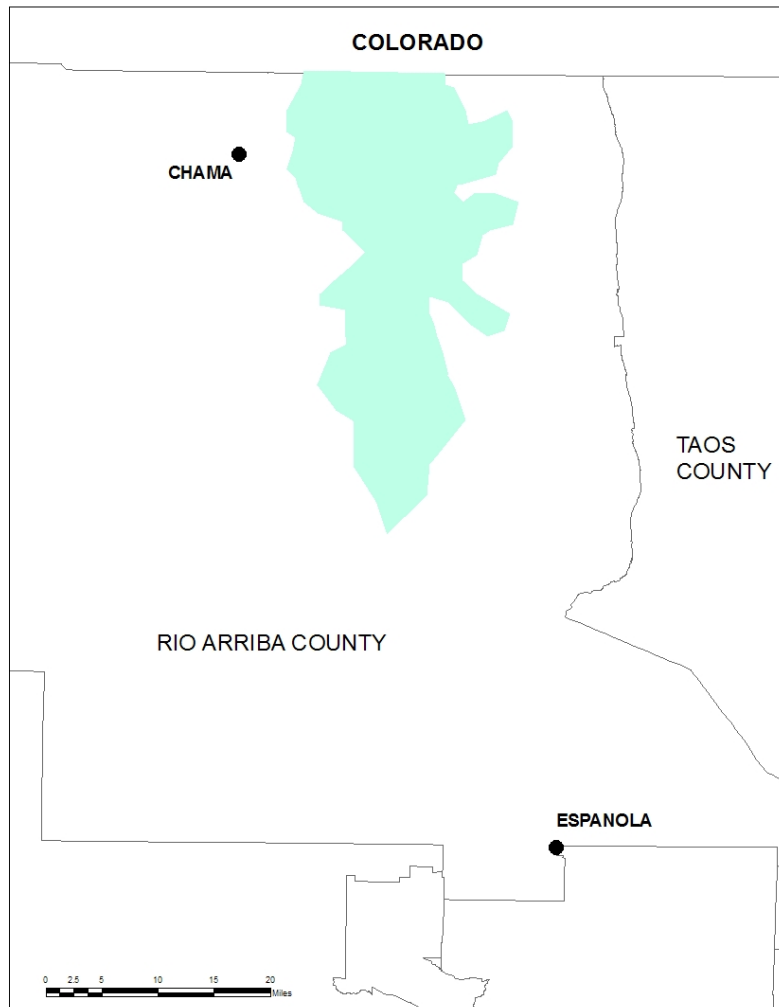


Figure 2. Potential Distribution of the Boreal Toad in New Mexico (Painter and Pierce 2000, unpublished report).

In New Mexico, the Boreal Toad was confirmed from three locations along the San Juan Mountains in Rio Arriba County at Lagunitas, Canjilon, and Trout Lakes (Stuart and Painter 1994, Figure 2).

Lagunitas Lakes. These lakes are in extreme northern New Mexico, ca. 24.4 km (17 mi) northeast of Tierra Amarilla, New Mexico, in the Carson National Forest. Approximately 25 lakes, from ca. 0.5 ha (1.2 ac) to ca. 2.0 ha (4.9 ac) for the two main ponds, are found in the Lagunitas Creek drainage between 3140 and 3200 m (10302 and 10499 ft) elevation. The shoreline is a mix of sedges (*Carex* spp.) and bare rock.





Figure 3. Typical habitat at Lagunitas Lakes in Rio Arriba County, New Mexico.

Nearby forests include Corkbark Fir (*Abies lasiocarpa*), Englemann Spruce (*Picea engelmannii*) and Quaking Aspen (*Populus tremuloides*). These lakes are used for recreation, mostly fishing, and the NMDGF stocks the two main ponds with rainbow trout (*Oncorhynchus mykiss*), at an average of 2030 trout per year since 1998 (NMDGF Fisheries Division). Fathead Minnows (*Pimephales promelas*) are present throughout all lakes (Stuart and Painter 1994). The Boreal Toad was first recorded in New Mexico at these lakes from surveys in 1966 (Campbell and Degenhardt 1971). Jones (1978) estimated 327 toads were present at Lagunitas Lakes in 1978, while Woodward and Mitchell (1985) estimated that only four or fewer female Boreal Toads bred at these lakes in 1985. Woodward and Mitchell (1985) observed ca. 20 tadpoles in 1984, and ca. 2000 in 1985. Carey (1987) found ca. ten toads at the lakes in August of 1985, and numerous one-year old toads in 1986. In a letter to the NMDGF, Carey reported being unable to find toads at Lagunitas Lakes in 1987 (Degenhardt et al. 1996). In 1993, no Boreal Toad adult or tadpoles were found (Stuart and Painter 1994). Nor were any adults or tadpoles found during surveys in 2000-2002 (E. Nelson, US Forest Service, personal communication).

Canjilon Lakes. These lakes are in the Carson National Forest, ca. 16.6 km (10 mi) north and east of Canjilon, New Mexico, at ca. 2960 and 3110 m (9711 and 10203 ft) elevation. Approximately 20 lakes form this complex of water bodies, four of which are upwards of 1.0-2.0 ha (2.5-4.9 ac) in size. Shoreline is mostly sedges. Nearby forests include Corkbark Fir, Englemann Spruce and Quaking Aspen. The NMDGF built a dam there in 1947 (NMDGF unpublished report 2004), and stocks the lakes with rainbow trout, with an average of 7056 trout stocked per year since 1998 (NMDGF Fisheries Division). The area is heavily used by fishermen during the summer, and Stuart and Painter (1994) report the installation of a large embankment on one of the largest lakes. Fathead Minnows are present throughout all the lakes (Stuart and Painter 1994). The Boreal Toad was first recorded at Canjilon Lakes from a survey in 1969 (Campbell and Degenhardt 1971). In 1978, little or no reproduction was observed (Jones 1978), and no toads were found by Woodward and Mitchell (1985).



Likewise, Stuart and Painter (1994) found no evidence of the Boreal Toad at Canjilon Lakes in 1993. No adults or tadpoles found during surveys in 2000-2002 (E. Nelson, US Forest Service, personal communication).

Trout Lakes. These lakes are ca. 15 km (9 mi) north and east from the Canjilon, New Mexico, at ca. 2775 and 2865 m (9104 and 9370 ft) elevation. Approximately 6 ponds are found in the Rio Nutrias drainage, ranging in size between ca. 0.5 to ca. 2.0 ha (1.2 to 4.0 ac). Shoreline is mostly sedges. Nearby forests include Corkbark Fir, Englemann Spruce and Quaking Aspen. The NMDGF built a dam for the lake in 1949 (NMDGF unpublished report 2004), and stocks the lakes with rainbow trout, with an average of 3570 trout stocked per year since 1998 (NMDGF Fisheries Division). Only one lake receives significant recreational use (Stuart and Painter 1994). Fathead Minnows are present throughout all the lakes (Stuart and Painter 1994). Boreal Toads were found in low densities by Jones (1978), but were absent during subsequent surveys (Woodward and Mitchell 1985, Stuart and Painter 1994). No adults or tadpoles found during surveys in 2000-2002 (E. Nelson, US Forest Service, personal communication).

A sighting of the Boreal Toad was reported ca. 11.2 km (7 mi) east southeast of Chama, at Bobo Lake in 1996, on private property, but the NMDGF was unable to confirm this (C. Painter, NMDGF, personal communication). Jones (1978) was unable to find the Boreal Toad at Hopewell Lake, ca. 29 km (18 mi) west of Tres Piedras, New Mexico, and, of the 115 lakes sampled in 1985 and 1986 throughout Rio Arriba County, Woodward and Mitchell (1985) only found the Boreal Toad at Lagunitas Lakes.

2.1.4 Required Habitats

The Boreal Toad, including the southern Rocky Mountain population, is found at high elevations in a variety of aquatic habitats such as slow-moving streams, lakes, marshes, alpine meadows, and beaver ponds, normally associated with lodgepole pine or spruce-fir forests (Degenhardt et al. 1996, Loeffler et al. 2001). Still, persistent water is ideal for breeding habitat, often with a sloping bank that creates a variety of water depths; water less than 10 cm (4 in) is used for breeding, and is likely a cue for oviposition (Holland et al. 2006). Elevation ranges from 2250 to 3600 m (7382 to 11811 ft; Loeffler et al. 2001). Adult toads move away from breeding areas into high grasses, and surrounding forests (Degenhardt et al. 1996, Loeffler 2001). The Boreal Toad is not likely to be found in lower elevation ponderosa pine forests (Loeffler 2001).

2.1.5 Food Habits

Little has been studied on the food habits of the Boreal Toad, but the species is likely to prey upon small invertebrates, as do other members in the family Bufonidae (true toads) found in New Mexico (Degenhardt et al. 1996). Primary food sources for Western Toads include spiders, worms, ants, moths, beetles, and other arthropods (Lannoo 2005). Larval Western Toads feed upon filamentous algae, detritus, and perhaps carrion (Lannoo 2005).

2.1.6 Reproductive Biology

In Boreal Toads, sexual maturity is achieved at 4 years of age for males, 6 years of age for females (Carey 1976, 1987). The late age of first reproduction is likely due to the short amount of time available for growth each year at high elevation habitats where *Bufo boreas boreas* is found. Females seem to reproduce every other year (Carey et al. 2005). Size at maturity ranges between 60 and 100 mm (2.9-3.4 in) SVL. Male Boreal Toads do not have well-developed vocal sacs, and therefore are generally lacking in advertisement calls for mates (Degenhardt et al. 1996).



Eggs are round and black in long strings of jelly, with between 3000 and 10000 eggs per string, and eggs tend to be laid at a breeding pond on the north, northwestern, or northeastern shores, where it is sunniest (Loeffler 2001, Carey et al. 2005). A significant, positive relationship exists between the size of the female and the egg mass and volume produced (Carey et al. 2005). Carey (1987) found a clutch of eggs at Lagunitas Lakes in June, and Jones (1978) found toadlets in August. Degenhardt et al. (1996) proposed breeding in the Boreal Toad occurs between May and June in northern New Mexico.

2.1.7 Growth and Longevity

Growth has not been studied in the Boreal Toad, but is likely slow, given the short time available for growth and the exposure to cold overnight temperatures (Degenhardt et al. 1996). Further, within the brief time available for growth, body temperatures in adult toads can vary wildly from as low as 0 °C, with no chance for growth, to as much as 30 °C, which may be too high for activity (Carey et al. 2005). Loeffler et al. (2001) indicated that Boreal Toad can live up to 12 years.

2.1.8 Movement

Male Boreal Toads tend to have high site fidelity, often staying within 300 m (984 ft) of breeding sites, whereas females may range 2.5 to 4 km (1.5 - 2.4 mi) away (Loeffler et al. 2001, Carey et al. 2005). The Boreal Toad can be active at temperatures as low as 3° C (37.4° F) (Degenhardt et al. 1996). Jones (1978) reported Boreal Toads movements to average 6.7 m/day (22ft/day), with activity being reduced between 1200 and 1400 hrs. Boreal Toads will seek to escape by jumping into water and finding refuge toward the bottom. Campbell (1970) suggested Boreal Toads make use of hibernacula over the winter, observing the species in small chambers near a stream in Colorado; flow of groundwater kept the chambers from freezing.

2.1.9 Predators, Competitors, and Diseases

Numerous species prey upon the Boreal Toad, including Tiger Salamanders (*Ambystoma tigrinum*), Garter snakes (genus *Thamnophis*), Red-Tailed Hawks (*Buteo jamaicensis*), Common Ravens (*Corax corax*), and Raccoons (*Procyon lotor*; Livo 1998, Hammerson, 1982, Jennings et al. 1992, Jones and Stiles 2000, Jones et al. 1999, Corn 1993, Olson 1989, Long 1964). The interaction of introduced sport fishes (*Oncorhynchus* sp.) and the Boreal Toad is complex. In laboratory experiments introduced sport fishes have been implicated in the transmission of a fungus (*Saprolegnia ferax*) that has been found to be lethal to Boreal Toad eggs (Kiesecker and Blaustein 1997). On the other hand both field and laboratory experiments indicate that Boreal Toads are unpalatable to sport fishes due the bufotoxins in the Boreal Toad's skin (bufondienolides; Kiesecker et al. 1996, but see also Gunzburger and Travis 2005) such that the fish may avoid the toad. Woodward and Mitchell (1985) suggest that the tadpoles of Chorus Frogs (*Pseudacris triseriata*) and Tiger Salamanders are competitors for food and space with Boreal Toad tadpoles. In Colorado, embryo and tadpole mortality were attributed to desiccation, freezing, sterility, poor water quality, fungus, and low temperatures, and considerable juvenile mortality was observed over the winter (Carey et al. 2005). The hydroperiod of the breeding ponds, how early or late a pond became available, and how long it lasted, also contributed to the success or failure of breeding attempts by the Boreal Toad (Carey et al. 2005).

Loeffler et al. (2001) suggested that the bacteria *Aeromonas hydrophila* and the fungus *Basidiobolus ranarum* might negatively impact the Boreal Toad, while Carey (1993) suggested that declines in *Bufo boreas boreas* are due to a combination of environmental stressors and suppression of the toad's immune system. One such stressor may be increased UV-B exposure due to climatic changes; juvenile Boreal Toads in Oregon often bask up to 10 hours per day in direct sunlight through shallow water (Blaustein et al. 2005). Finally, a review of eleven years of population data for the Boreal Toad for two populations in Colorado demonstrated the negative



impacts of chytrid Fungus (*Batrachochytrium dendrobatidis*) on the species (Muths et al. 2003, Scherer et al. 2005). Chytrid Fungus has been implicated in severe population declines, even the complete eradication of certain populations and species (Berger et al. 1998). Upon infection, the fungus lives inside the cells in the superficial layer of amphibian skin, leading to thickening, or hyperkeratosis, of the skin. This in turn may lead to interference in water absorption and even the ionic balance in the blood systems of an amphibian (Lannoo 2005, C. Carey, personal communication). Further, male Boreal Toads tend to congregate together each year, whereas females may only breed every other year, creating the situation where chytrid fungus is transmitted more rapidly through the male portion of the population; therefore, even if the population is not severely impacted by the presence of the fungus, the sex ratio of the population may still become skewed beyond normal, healthy ranges.

2.2 HISTORICAL PERSPECTIVE

2.2.1 Habitat Trends

Over approximately the last 18,000 years the region of New Mexico occupied by the Boreal Toad has remained relatively unchanged, a mix of subalpine and montane coniferous forest zones (Dick-Peddie 1993). Within these broad zones the Boreal Toad occupies riparian habitat (See Section 2.1.4, Required Habitats); all riparian habitats have been identified as key focal points for future conservation efforts in New Mexico (NMDGF 2005). Many forms of disturbance, such as grazing, flooding, alteration of water flow, and recreational activity may alter riparian habitat resilience, in some cases improving the habitat, in other cases harming it (Szaro 1984). Human activity in the part of New Mexico occupied by the Boreal Toad, particularly hunting and fishing, has increased over recent decades (See Sections 2.1.3, Distribution, and 2.4.1, Economic Profile).

Concerns over global climate change, particularly global warming, have been put forth with regard to declining amphibian populations (Pounds and Crump 1994, Pounds et al. 2006). Amphibians are particularly susceptible to the effects of drought (Scherer et al. 2005), and global warming has also been implicated in the devastating impact of an epidemic pathogen, (*Batrachochytrium dendrobatidis*) in toad species in South and Central America (Pounds et al. 2006, See Section 2.1.9, Predators, Competitors, and Diseases). The trend for the average temperature in July in New Mexico, when the Boreal Toad is active, has been for an increase of 0.83° C (1.5°F) per decade over the last twenty years (National Climatic Data Center, National Environmental Satellite, Data, and Information Service, <http://www.ncdc.noaa.gov/oa/ncdc.html>).

2.2.2 Population Trends

The family of which the Boreal Toad belongs, the True Toad Family (Bufonidae) has been discovered to suffer among the highest declines in populations of all amphibians (Stuart et al. 2004). Populations of the Western Toad have declined in some places in its range, such as in Puget Sound, Washington, and particularly in the isolated populations in Wyoming, Colorado, and New Mexico (Lannoo 2005, Figure 1). Since the discovery of the Boreal Toad in 1966 at Lagunitas Lakes, the species has declined in New Mexico, and was not found in 1993 or 2000-2002 (Stuart and Painter 1994, E. Nelson, US Forest Service, personal communication). Degenhardt et al. (1996) suggest that the Boreal Toad may no longer exist in New Mexico.

2.2.3 Use and Demand Trends



At present there appears to be no use of or demand for the Boreal Toad, as there is no evidence that the toad has been subject to either commercial or recreational collection. The potential exists for *Bufo boreas boreas* to be of interest to herpetocultural enthusiasts, given its rarity.

2.2.4 Past Management

On September 30, 1993, the US Fish and Wildlife Service(USFWS) received a petition to list the “western Boreal Toad” as endangered and that critical habitat be designated, from the Biodiversity Legal Foundation located in Boulder, Colorado, and Dr. Peter Hovingh, a professor at the University of Utah. The USFWS then determined the Boreal Toad to be warranted but precluded for listing. In September, 2005, the USFWS announced that the southern Rocky Mountain population of the Boreal Toad was withdrawn from the candidate list, due to the population not constituting “... a species, subspecies, or distinct population segment under the Endangered Species Act” (USFWS 2005). Should more information become available, listing might be revisited (L.Thompson, Western Colorado Field Office, US Fish and Wildlife Service, prsonal communication). The Boreal Toad was listed as endangered by the Colorado Division of Wildlife in November 1993 (Loeffler et al. 2001), and listed as endangered by the NMDGF in 1976 (NMDGF 1990).

2.3 HABITAT ASSESSMENT

The Boreal Toad is associated with high elevation habitats that include ponds, lakes, marshes, and roadside ditches. The Boreal Toad is normally associated with lodepole pine and spruce-fir forests (Loeffler et al. 2001, see Section 2.1.4, Required Habitats).

2.3.1 Status

The Boreal Toad has been reported from three localities in New Mexico; Lagunitas, Canjilon, and Trout Lakes in north-central Rio Arriba County. All three sites are stocked for recreational fishing, and receive moderate to heavy use by sportsman each year.

2.4 ECONOMIC AND SOCIAL IMPACTS

2.4.1 Economic Profile

The three known localities for the Boreal Toad are all from Rio Arriba County in northern New Mexico. As of the 2000 United States Census, the county of Rio Arriba had a human population of ca. 41,190, a 19.9% increase from 1990 (U.S. Census Bureau 2000, <http://www.census.gov/>). Rio Arriba County is a large county at 15,171 square kilometers (5,858 sq. mi.). Per capita personal income was \$20,720 (New Mexico Economic Development Department, <http://www.edd.state.nm.us/>). The main industries for the county are local government (35.6% of total employed persons), health care and social assistance (19.9%), retail trade (12.5%), accommodation and food services (7.6%), state government (5.3%), construction (4.2%), and federal government (3.2%), as of 2004 (New Mexico Department of Labor, <http://www.dol.state.nm.us/>). As of May 2005, the unemployment rate for Rio Arriba County was 6.5% (N. M. Dept. of Labor). In 2002, 988 farms were in operation in Rio Arriba County (not including individual farms on Native American jurisdictions), a 2.5% increase from 1992 (New Mexico Department of Agriculture, <http://nmdaweb.nmsu.edu/>). Rio Arriba County ranked third in the state for all counties in New Mexico for oil and gas production in 2005, behind Lea and Eddy Counties (New Mexico Energy, Minerals, and Natural Resources Department, <http://www.emnrd.state.nm.us/EMNRD/MAIN/index.htm>).



2.4.2 Economic Use of Habitat

One chief economic use of the three original localities for the Boreal Toad is recreational fishing, with NMDGF currently stocking the ponds at Lagunitas, Canjilon, and Trout Lakes. Based upon mail surveys of anglers, an average of 1414 fish have been harvested every year since the 1997-1998 fishing season at Lagunitas Lakes, an average of 5877 fish per year at Canjilon Lakes, and an average of 2102 fish per year at Trout Lakes (NMDGF Fisheries Division). This activity likely restricts other potential economic uses of this area that might negatively impact upon the habitat, such as draining of the wetlands or water contamination.

2.4.3 Sociological Factors

The three original localities for the Boreal Toad in New Mexico are all found on U. S. Forest Service lands, and the species is known chiefly from high elevations (and thus lower human population densities). However, many potential Boreal Toad habitats can be found across the northern part of the State; a chief social misgiving would be for private property to be negatively impacted by the discovery of the species on that land. The recent removal of the Boreal Toad from the Federal Candidate list (USFWS 2005) changes such perceived social impacts, in that for the foreseeable future there will be no designation of critical habitat, or other Endangered Species Act-related requirements. However, even with listing, safe harbor agreements and federal funding would be available to aid private landowners (L.Thompson, Western Colorado Field Office, US Fish and Wildlife Service, personal communication). Further, the New Mexico Wildlife Conservation Act has no provision for restricting private property use to protect any species. Lastly, through a cooperative process such as this Recovery Plan, private landowners and the State can work to further the survival of any toads found on the landowner's property in a positive fashion for both the Boreal Toad and the landowner.

3.0 Management Strategy

3.1 MANAGEMENT GOAL AND OBJECTIVE

Goal: Ensure the long-term persistence of natural densities of the Boreal Toad within its natural range in New Mexico, thereby contributing to the maintenance of the biological diversity in the State.

Objective: That by 2025, the populations and distribution of the Boreal Toad are sufficient to ensure its persistence within New Mexico, as part of the southern Rocky Mountain population.

Objective Parameters:

All existing populations identified.

Suitable habitat that may be used for repatriation identified.

Threats are identified and managed such that the population faces no known, significant, and imminent threat to its habitat, health, and environmental conditions.

Establish and maintain secure populations such that no single event threatens the security of the species in New Mexico.

3.2 MANAGEMENT ISSUES AND STRATEGIES

3.2.1 Issue 1-Need for Current Distribution Information.

Lack of precise information concerning current habitats and populations of the Boreal Toad prevent establishment and maintenance of secure populations of the species. The last



confirmed sighting of the species in New Mexico was in 1986. Therefore, if the species still exists in New Mexico, its populations may be vulnerable to extirpation.

Strategy 1. Complete multiyear surveys of known historical localities, based upon established protocols.

Strategy 2. Identify and survey potential suitable habitats across natural range in New Mexico, based upon established protocols.

Strategy 3. Develop a monitoring program to assess the stability of any populations found in New Mexico.

3.2.2 Issue 2-Need for Information on Biology and Natural History of the Boreal Toad

Much of the biology and natural history of the Boreal Toad is not well understood, particularly for New Mexico and the southern Rocky Mountain population. It is important to gather such information to improve the success of recovery efforts.

Strategy 1. Support research into the biology and natural history of the Boreal Toad, to determine the population dynamics necessary to sustain the species in New Mexico.

Strategy 2. Support research into the genetic status of the southern Rocky Mountain population of the Boreal Toad, to determine suitable sources for repatriation.

Strategy 3. Support research into best practices for repatriation of the Boreal Toad in New Mexico.

3.2.3 Issue 3-Need for Information on Threats to New Mexico Populations.

While chytrid fungus (Batrachochytrium dendrobatidis) is considered the leading cause for the decline of the Boreal Toad in New Mexico, the precise reason for the decline is still unknown. Other factors, such as climate change, human activity, other fungi, non-native species, and disease may also contribute to the decline. It is important to determine the impacts of such threats to improve the success of recovery efforts.

Strategy 1. Identify and manage potential threats to Boreal Toads and their habitat.

Strategy 2. Survey for the presence of chytrid fungus, based upon standard protocols.

Strategy 3. Support research into impacts of chytrid fungus on Boreal toad populations.

Strategy 4. Support research into control of chytrid fungus.

Strategy 5. Support research into the potential impacts of drought on the Boreal Toad.

Strategy 6. Support research into resistance to chytrid fungus in the Boreal Toad.

3.2.4 Issue 4-Management issues

The known historic localities for the Boreal Toad in New Mexico are each on United States Forest Service Lands. The potential also exists for the species to be found or repatriated on Federal, State, Tribal, and private lands. Coordination of efforts will allow such entities to pursue their own goals while maintaining efforts to recover the Boreal Toad.

Strategy 1. Identify and secure funding to promote the goals of this recovery plan.



Strategy 2. Create a recovery-working group of stakeholders and managers to coordinate efforts, guide the direction of conservation efforts, and develop agreements as necessary among interested parties.

Strategy 3. Maintain involvement in the Southern Rocky Mountain Population recovery team.

Strategy 4. Providing technical guidance and assistance to interested landowners in conserving or repatriating Boreal Toad populations on their properties.

Strategy 5. Develop public information and outreach program to inform the public about the Boreal Toad, and the importance of reporting potential sightings of the species.

Strategy 6. Identify and support as necessary breeding facilities to aid in recovery of the Boreal Toad in New Mexico.

Strategy 7. Establish new populations in suitable habitat in New Mexico.



4.0 Implementation Schedule

Section 4.0 contains the Implementation Schedule for the Recovery Plan. Section 4.1 identifies specific tasks to be carried out to meet the strategies identified in Section 3.2 (Management Issues and Strategies). Section 4.2 presents a suggested time-line for the Implementation Schedule; this includes a time-line for any native Boreal Toads reaching sexual maturity from hatching in 2006 and any repatriated Boreal Toads reaching sexual maturity from a proposed date of 2009. Anticipated costs, including staffing, for these tasks will be addressed in an Operational Plan, to be developed following final approval of the Recovery Plan by the New Mexico State Game Commission

4.1 IMPLEMENTATION SCHEDULE TASKS

4.1.1 Improve and maintain knowledge of status of the Boreal Toad

- 4.1.1.1 Develop survey protocols
- 4.1.1.2 Survey three historic localities for three years to assure presence or absence of species
- 4.1.1.3 Develop means of identifying potential habitats for the Boreal Toad to be surveyed
- 4.1.1.4 Develop relationships and any necessary agreements with stakeholders to allow surveys of potential habitats
- 4.1.1.5 Survey potential habitats for the Boreal Toad for three years to assure presence or absence of the species
- 4.1.1.6 Develop protocols for monitoring populations of the Boreal Toad
- 4.1.1.7 Consult with stakeholders and citizens about any potential sightings of the species
- 4.1.1.8 Develop public information and outreach programs for any potential sightings of the species.

4.1.2 Improve and maintain knowledge of the biology of the Boreal Toad

- 4.1.2.1 Support research into the natural history of the Boreal Toad
- 4.1.2.2 Identify parties interested in conducting research on the biology of the Boreal Toad
- 4.1.2.3 Support research into the genetic structure of the southern Rocky Mountain population of the Boreal Toad for genetic identification to aid in any repatriation efforts
- 4.1.2.4 Support research into the genetic structure of the southern Rocky Mountain population of the Boreal Toad for determination of species status
- 4.1.2.5 Support research into developing a best practices protocol for any repatriation efforts
- 4.1.2.6 Develop public information and outreach programs for coordinating and sharing information on the biology of the Boreal Toad.

4.1.3 Develop and maintain high levels of cooperation and coordination between stakeholders and interested parties

- 4.1.3.1 Formulate a Boreal Toad Recovery Team Working Group
- 4.1.3.2 Develop operational plan for the Recovery Plan
- 4.1.3.3 Identify measures of success for the Recovery Plan
- 4.1.3.4 Identify all stakeholders and interested parties
- 4.1.3.5 Identify any agreements necessary to aid in the recovery of the Boreal Toad
- 4.1.3.6 Determine if restocking of known locations of the Boreal Toad is necessary for the recovery of the species, and, if so, develop a protocol for such a program
- 4.1.3.7 Identify measures of success for any restocking program(s)
- 4.1.3.8 Determine if repatriation of the Boreal Toad is necessary for the recovery of the species, and, if so, develop a protocol for such a program
- 4.1.3.9 Identify measures of success for any repatriation program(s)
- 4.1.3.10 Identify potential funding sources
- 4.1.3.11 Acquire funding for the Recovery Plan



4.1.4 Improve and maintain knowledge of potential threats to the Boreal Toad

- 4.1.4.1 Support research into potential threats to populations of the Boreal Toad
- 4.1.4.2 Identify parties interested in research on potential threats to the Boreal Toad
- 4.1.4.3 Survey historic localities for presence of chytrid fungus
- 4.1.4.4 Support research into the impact of chytrid fungus on populations of the Boreal Toad
- 4.1.4.5 Support research into the impact of climatic change at various scales on populations of the Boreal Toad.

4.2 IMPLEMENTATION SCHEDULE TIME-LINE

Time Frame	Breeding Stage	Population Surveys	Coordination	Chytrid Fungus Surveys	Support and Outreach	Research	Monitoring	Repatriation and Restocking
2 nd Half 2006	Larvae leave breeding ponds	Pre-plan surveys at Original Localities	Commission approval; Formation of Recovery Working Group	Pre-plan Surveys at Original Localities	Pre-plan PIO			Status of Colorado breeding populatin identified
1 st Half 2007		Original Localities, New	Development of operation plan, success measures, protocols; necessary agreements	Original Localities, New	Funding Sources sought; PIO	Funding Sought	Monitoring of known populations	Potential sites identified
2 nd Half 2007		Original Localities, New	Development of necessary agreements for repatriation	Original Localities, New	Funding Sources sought; PIO	Potential new sites analysis	Monitoring of known populations	Potential sites identified
1 st Half 2008		Original Localities, New	Development of necessary agreements for repatriation	Original Localities, New	Funding Sources sought; PIO		Monitoring of known populations	Breeding of any necessary populations
2 nd Half 2008		Original Localities, New	Development of necessary agreements for repatriation	Original Localities, New	Funding Sources sought; PIO		Monitoring of known populations	Breeding of any necessary populations
1 st Half 2009	Example: Repatriation of Boreal Toad Larvae	New Localities; Acquire Natural History Information			Funding Sources sought; PIO; central information resource developed		Monitoring of known populations	If necessary, restocking and/or repatriation
2 nd Half 2009		New Localities; Acquire			Funding Sources sought;		Monitoring of known and any	If necessary, restocking



		Natural History Information			PIO; central information resource developed		repatriated populations	and/or repatriation
1 st Half 2010	2006 Male Boreal Toads Sexually Mature	New Localities; Acquire Natural History Information			Funding Sources sought; PIO; central information resource developed		Monitoring of known and any repatriated populations	If necessary, restocking and/or repatriation
2 nd Half 2010		New Localities; Acquire Natural History Information			Funding Sources sought; PIO; central information resource developed		Monitoring of known and any repatriated populations	If necessary, restocking and/or repatriation
1 st Half 2011								
2 nd Half 2011								
1 st Half 2012	2006 Female Boreal Toads Sexually Mature							
2 nd Half 2012								
1 st Half 2013	2009 Repatriated Male Boreal Toads Sexually Mature							
2 nd Half 2013								
1 st Half 2014								
2 nd Half 2014								
1 st Half 2015	2009 Repatriated Female							



	Boreal Toads Sexually Mature							
2 nd Half 2015								



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6.0 Approvals

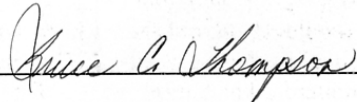
This Recovery Plan for the Boreal Toad is approved by:



Lisa Kirkpatrick, Conservation Services Division Chief
New Mexico Department of Game and Fish

11/21/06

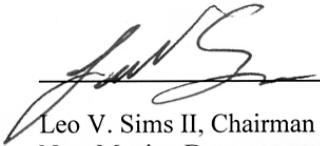
Date



Bruce C. Thompson, PhD., Director and Secretary to the Commission
New Mexico Department of Game and Fish

11-29-06

Date



Leo V. Sims II, Chairman
New Mexico Department of Game and Fish

11-27-06

Date



7.0 Appendices

7.1 HISTORY OF PUBLIC PARTICIPATION

12 December 2005, Chama, NM: Public meeting to announce the initiation of a Recovery Plan for the Boreal Toad (*Bufo boreas boreas*). 2 attendees + 3 NMDGF employees.

January 2006: Formed Advisory Committee

March 2006: Advisory Committee review of background of Recovery Plan

April 2006: Advisory Committee development of components of management section of Recovery Plan

24 May 2006, Chama, NM: Meeting of Advisory Committee to develop management section of Recovery Plan for the Boreal Toad. 4 attendees + 2 NMDGF employees.



Figure 4a. Participants of May 24th 2006 meeting in Chama, NM, to formulate management section for the Recovery Plan for the Boreal Toad (*Bufo boreas boreas*): Chuck Hayes (NMDGF), Tina Jackson (CO DOW), Ken Boykin (NMSU), and Jose Carrillo, Jr. (EMNRD). Not pictured: Craig Fetkavich (Private Citizen).



Figure 4b. Participants of May 24th 2006 meeting in Chama, NM, to formulate management section for the Recovery Plan for the Boreal Toad (*Bufo boreas boreas*): Tina Jackson (CO DOW), Ken Boykin (NMSU), and Jose Carrillo, Jr. (EMNRD), Leland Pierce (NMDGF). Not pictured: Craig Fetkovich (Private Citizen).

June 2006: Advisory Committee review of proposed management section of the Recovery Plan

July 2006: Internal NMDGF review of the Recovery Plan.

7.2 LISTING OF INTERESTED PARTIES AND MEMBERS OF ADVISORY COMMITTEE

Active participants on the Boreal Toad Recovery Plan Advisory Committee in **Bold**:

Colorado Division of Wildlife-**Tina Jackson**

Forest Guardians-Sam Hitt

New Mexico Energy, Minerals, and Natural Resources Department, Forestry Division-**Jose Carrillo**

New Mexico Environment Department-Gary Schiffmiller

New Mexico State Land Office-Shawn Knox

New Mexico State University-**Ken Boykin**, Vanessa Gutierrez

Private Citizen-**Craig Fetkovich**, Ariana Kramer, Richy Green, Jai Cross, Bruce Christman

U. S. Fish and Wildlife Service-Patricia Zenone

U. S. Forest Service-Donna Storch, Joseph Lujan, and **Esther Nelson**

University of New Mexico-**Dr. Howard Snell, Jacek Tomas Giermakowski**, Kurt Menke, Dr. Kris Johnson

Vallecitos Refuge-Leigh Lauck

