

Colorado Division of Wildlife
Boreal Toad Research Progress Report
2000



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April 2001

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Introduction

Boreal toads (*Bufo boreas*) previously were considered common amphibians in the mountains of Colorado (see, for example, Burnett, 1926; Burt, 1933; Burger and Bragg, 1947; Blair, 1951; Campbell, 1970). Colorado's boreal toad populations mysteriously declined beginning in the 1970s (Corn et al., 1989; Carey, 1993). The Boreal Toad Recovery Team was formed in 1994, in response to reports of significant declines in boreal toad distributions in the Southern Rocky Mountains. These apparent declines resulted in an "Endangered" listing by Colorado and New Mexico and a "Status 2" species designation in Wyoming. The boreal toad is currently considered "warranted but precluded" for federal listing under the Endangered Species Act. The first Boreal Toad Recovery Plan was completed in 1994 (revised Jan. 1997) under the direction of John Goettl; the Recovery Plan and Conservation Agreement have now been combined into one working document titled the Conservation Plan and Agreement (Loeffler [ed.] 1998). This document is currently under revision to keep content applicable to ongoing activities and to document progress. The Boreal Toad Recovery Team is coordinated by Chuck Loeffler, the Colorado Division of Wildlife (CDOW) Wildlife Manager for Reptiles, Amphibians, Mollusks, and Crustaceans.

Since 1995, a broad range of research has been completed, by numerous members of the Recovery Team, as outlined in the Conservation Plan and Agreement. Highlights of this research include UV-radiation impacts, statewide genetic analyses, heavy metal toxicology, habitat use and movement, early life history ecology, predators, long term population monitoring, immunology, pathology, and other topics (*****). This research constitutes great progress toward our understanding of boreal toad biology and the circumstances which resulted in population declines.

In the late 1990s, researchers discovered a chytrid fungus (*Batrachochytrium dendrobatidis*) infecting frogs at areas experiencing amphibian population declines in Central America and Australia (Berger et al., 1998; Berger et al., 1999; Longcore et al., 1999). In 1999, a decline in the Henderson/Urad boreal toad population was attributed to this "frog chytrid" (Jones, 2000; Livo, 2000; Milius, 1999). Subsequent pathological work by Dr. Allan Pessier has shown that chytrid fungus was present at this locality as early as 1995. Chytrid fungus has now been identified in boreal toads from at least three populations and evidence exists that this pathogen was in Colorado during the declines in the late 1970's and early 1980's (Carey et al. 1999).

The chytrid life cycle begins with a motile zoospore, which is the infective stage of this pathogen. During the course of infection, chytrid zoospores enter skin cells on the amphibian. The fungus grows and develops asexually within the skin cells. Eventually, discharge tubes form that extend to the surface of the cells. Mature zoospores emerge from the discharge tube and begin the life cycle again (Longcore et al., 1999). Infections are restricted to the skin of the amphibian. Infected amphibians often slough the skin more frequently than healthy amphibians. Future research must be aimed at mitigating the adverse impacts of this pathogen on the boreal toad, both in the wild and in captivity.

Funding for boreal toad research and recovery efforts in Colorado have been provided by Great Outdoors Colorado.

HENDERSON/URAD BOREAL TOAD STUDIES

SITE DESCRIPTION AND BACKGROUND

Research on population size, stability, movement, and habitat use has been conducted at the Henderson/Urads Mine since 1995. The Henderson Mine breeding locality consists of numerous ponds and wetlands in an area which is heavily disturbed due to molybdenum mining by the Climax Molybdenum Company. The mine is located west of Empire, Colorado at an elevational range of 10,000 to 10,500 feet. The specific breeding sites have been designated as follows: Power Alley, Hesbo, Treatment Pond, Donut, Anne's Pond, and Upper Urads (Figure 1).

Hesbo and 2-Pond were the main breeding locations in 1995 and 1996. Hesbo and Donut were the primary breeding sites from 1997 to 2000. In 1995 and 1996, Hesbo and 2-Pond were influenced by pre-treated mine effluent running through them at an elevated temperature of 19-21 °C. Climax finished a new water treatment facility on the Urads side of the facility in 1997. As a result, 2-Pond is no longer an active breeding site and Hesbo has reduced water temperatures in the spring and no long term source of water. As a result of the changes in water supply to Hesbo, we had to pump water to the site once each week from July to September during the 1998, 1999, and 2000 seasons. In an attempt to remedy this situation, the Mine provided a backhoe to install a dam and water control structure and increase the depth of the channel in October 1998. Structural modifications were also made to Anne's Pond in 1998. The improvements seemed to function well at Hesbo in 1999 and 2000 but Anne's Pond still went dry quickly. Even though Hesbo has the largest population of adult toads during breeding, this site did not recruit from 1995 to 1997. From 1998 to 2000, Dyticid beetle larvae were removed which resulted in substantial survival to metamorphosis in these years.

Power Alley is a beaver pond complex along the West Fork of Clear Creek and is the most natural breeding site in the area. It is not directly influenced by mine effluent and therefore the water temperature is colder than the previously mentioned sites and breeding occurs one to two weeks later. This site, however, has dried up during the last four years and desiccated the egg masses present. There were very few breeding adults at the Power Alley breeding site in 2000.

Treatment is a man-made wetland complex which is dissected by the Urads Mill Road located north of the water treatment facility. Breeding activity is restricted to the pond(s) on the west side of the road. It does not have a large number of adults during breeding but produced 10,000-15,000 toadlets in each year from 1996 to 2000. Recruitment at this site is low as there is minimal overwinter refuge for toadlets.

Donut is a newer pond above the water treatment facility which serves as a catch basin for some of the upstream runoff. This site typically has 5-6 egg masses but because it is higher in elevation than the other sites, breeding occurs later making weather conditions post metamorphosis critical to toadlet survival and dispersal. In addition, there are few suitable hibernaculum close to this site. All toadlets froze in 1995 and 1996. We believe that some toadlets survived in 1997. Survival of toadlets was

good in 1998 and 1999, presumably a result of increased vegetation and small mammal burrows on the islands. In 2000, metamorphosis was good at this site but survival is unknown.

Anne's Pond is a small wetland area south of Donut which is fed by ground water and runoff. Because the average depth is less than 10 cm, the water temperature stays warm and tadpoles grow quickly. In 1996 this pond had several thousand tadpoles but dried up in July. At our request, the Henderson Mine personnel put in a water supply pipe to keep the water level constant, which resulted in successful recruitment in 1997 and 1998. In October, 1998 we used a backhoe to increase the main channel depth and added a side channel; these drain to a deep water thermal refuge. As a result of water levels decreasing too quickly in 1999 and 2000 to successfully supplement water at this sight, all egg masses desiccated.

Upper Urad is a large, man-made wetland area at the west end of the valley at an elevation of 10,500 ft. Due to the elevation, this is the last site for breeding activity each year. It produced toadlets in 1995 and 1996 but they froze in 1995 and were eaten by sand pipers in 1996. No successful reproduction occurred at this site from 1997 to 2000.

*****12/13/00

Figure 1 Site Map

MATERIALS AND METHODS

Starting in 1996, all breeding sites have been surveyed one time during daylight hours and one time at night each week during the period when toads were actively breeding. Each site was surveyed according to the protocols outlined in the Conservation Plan and Agreement (Loeffler [ed.] 1998). Each toad captured during the night surveys was sexed, weighed (± 0.1 g), and measured (snout to urostyle length, ± 0.01 mm). Each individual was then scanned for a PIT tag and if one was not found, a tag (AVID ITI-125S) was inserted dorsally. The tags were inserted by pinching the skin on the toads back (slightly off center and anterior), making a small incision using sterile scissors, inserting the sterile tag in a posterior direction using forceps, and closing the incision using surgical adhesive. All PIT tag numbers were recorded along with the other pertinent data on individuals and site. All sites were monitored until no new individuals were encountered. All PIT tag numbers from 1995 to 2000 were entered into a database with other pertinent information on each toad. Water quality samples were taken at each breeding site a minimum of three times per year. Once in May, one time while tadpoles were present, and again during metamorphosis.

In January 2000, a contract was initiated with Dr. Seanna Annis and Dr. Joyce Longcore at the University of Maine at Orono to develop a polymerase chain reaction (PCR) test for *Batrachochytrium dendrobatidis*. At this time, it is not possible to sample the environment (water, soil, and so on) for the chytrid fungus. However, because the chytrid fungus infects the skin of an amphibian, it is possible to obtain samples from the amphibians themselves that can be tested for chytrid. The amphibians can be released after collection of the sample. Samples for PCR testing for chytrid fungus were collected from approximately 150 adult toads from 26 boreal toad breeding sites in 2000. Three samples were taken from each individual. First each toad was soaked for two hours in 10 ml of distilled water in an attempt to collect the flagellated *Batrachochytrium* zoospores. The second sample was a ventral skin scraping using a wood sample stick. The third sample was a toe clip. Toe clips and wood sticks were put into screw cap cryogenic tubes containing 1 ml of 0.25M EDTA pH 8 saturated with NaCl. The soak water sample was poured into a tube containing 1 ml 0.1M Tris, 0.1M NaCl, 0.1M EDTA, and 10% lauryl sarcosine, pH 7.5. Buffers for preserving sample tissues and soaks from Seutin et al., 1991.

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PCR Sample Collection

Solutions: Buffer solutions were provided by Seanna Annis, based on Seutin et al. (1991). Buffer A was comprised of 0.25M EDTA at pH8 saturated with NaCl. For each sample, 1 ml of Buffer A was placed in a 2 ml screw cap plastic cryogenic tube. Buffer B was comprised of 0.1M Tris, 0.1M NaCl, 0.1M EDTA, 10% lauryl sarcosine at pH7.5. For each sample, 1 ml of Buffer B was placed in a 15 ml screw top plastic test tube.

Sample collection: Boreal toad (*Bufo boreas*) breeding sites were visited during the 2000 field season. Each site was searched for adult and juvenile toads. When a toad was encountered, it was placed in an individual round ZipLoc® container (236 ml size) with a perforated lid.

Each toad soaked for two hours in 10 ml distilled water. After two hours, 10 ml of water was decanted into a test tube containing buffer B; if the toad had absorbed water, a few ml of additional distilled water was poured over toad and decanted to bring the level of liquid in the test tube to 11 ml (10 ml water plus 1 ml Buffer B). The purpose of this sample was to obtain any zoospores that may have been released while the toad was soaking.

The pointed end of a wooden stick (2-mm diameter) was scraped along the toad's ventral surface and the webbing of the rear feet. With some toads, this procedure dislodged skin that was in the process of sloughing, while with other toads no detectable material was dislodged. The end of the stick was cut off and placed, pointed end down, in a tube containing Buffer A.

Fine scissors were used to remove a toe from a rear foot (usually the right rear foot); the toe clip was stored in a tube containing Buffer A. The wound was sealed with a drop of 3M® Vetbond before the toad was released. Both the skin scrape and toe clip were collected to yield samples that might contain chytrid fungus within skin cells.

In addition to collecting samples from boreal toads, a limited number of samples from other amphibian species were collected. The same procedures were used for these animals as for the boreal toad, except for larval tiger salamanders (*Ambystoma tigrinum*). Because these animals are aquatic, they were soaked in 25 ml distilled water, 10 ml of which was decanted into the test tube with Buffer B.

All samples are being held at room temperatures pending completion and validation of the PCR test. To minimize the chance of introducing the chytrid fungus to amphibian populations, we adhered to Declining Amphibian Populations Task Force guidelines regarding disinfecting boots, nets, and other equipment between sites (guidelines are posted at http://www.mpm.edu/collect/vertzo/herp/Daptf/fcode_e.html). Disposable gloves were used and scissors and other sample collection equipment were disinfected before use with each toad.

Henderson Mine Radio Tracking

Nineteen toads (seventeen males and two females) were radio tagged in May and June 1999 at Hesbo, Donut, and Anne's Pond with Holohil BD-2G radio transmitters weighing 2g each, with an expected battery life of six months. The radios were fixed to the toads using a waist harness constructed of plastic coated fishing leader material fastened with crimp collars inside 2mm vinyl tubing. An additional seven toads (four males and three females) were tagged during the summer as replacements for individuals killed by various predators (Jones et al 1999, Jones and Stiles 2000), disease, or which lost their transmitters (Table 1). The primary objective of following radio tagged individuals in 2000 was to monitor mortality associated with chytridiomycosis.

Table 1. Contact statistics for radio-tagged boreal toads in the Henderson study area in 2000.

Date Tagged	Days Monitored	Sex	Comments
582	5/11/00	42 M	Dead 6/22/00, Path. No. 14
576	5/11/00	68 F	Radio quit 7/18/00
773	7/6/00	148 M	Hib. In willows above flume
575	5/15/00	33 M	Radio fell off 6/16/00
602	5/24/00	112 F	Dead 9/13/00, Path. No.21
47	5/31/00	20 M	Hawk kill
58	5/24/00	51 F	Lost signal at Berthoud Falls
88	5/24/00	13 M	Dead 6/6/00, Path. No. 5
98	5/23/00	141 M	Hib. By concrete flume
99	8/1/00	28 F	Predator kill, radio up tree by Lower Urad Res.
130	5/24/00	55 M	Dead in Lower Urad Res., not recovered
316	7/14/00	89 F	Hib. in 2nd berm below Hesbo
169	5/11/00	43 M	Dead 6/22/00, Path. No. 13
481	8/8/00	115 F	Hib. below Lower Urad dam by outlet
523	5/24/00	7 M	Radio fell off
580	5/31/00	29 M	Dead 6/29/00, Path. No.17
621	5/24/00	28 M	Dead 6/20/00, Hesbo Ditch, Path #12
642	5/15/00	150 M	Hib. below Hesbo by spring
711	5/31/00	29 M	Dead 6/29/00, Path. No. 16
730	9/13/00	28 M	Hib. below Hesbo
820	5/24/00	119 M	In berm below Hesbo, may be dead
839	5/31/00	14 M	Dead, didn't find for 3 weeks, Path. No. 19
867	8/1/00	71 M	Hib. top of concrete flume
940	5/31/00	20 M	Radio quit
918	5/11/00	5 M	Dead 5/15/00, Path. No. 1
920	7/21/00	82 F	Hib. below Hesbo by spring

Each radioed toad was located one time per week from May until they went into hibernation or were lost for various reasons. Toad locations were recorded in Universal Transverse Mercator (UTM) coordinates using a Trimble Pathfinder Basic Plus global positioning system (GPS) with an external antenna. Location files were downloaded to a computer, differentially corrected, and imported into ARC/INFO (ESRI 1997) for spatial analysis.

Pathology work in 2000 was performed by Dr. Allan Pessier, Zoo and Wildlife Pathologist with the University of Illinois Zoological Pathology Program. Specimens were either sent live on ice packs, preserved in formalin, or frozen with dry ice depending on their condition and the anticipated tests/procedures to be done.

Figure 2. Map of designated study areas in the Henderson/Urads area, 1999.

RESULTS and DISCUSSION

Breeding Site Monitoring: 2000

Hesbo-Hesbo was monitored at night weekly from May 11 to May 30, 2000. The peak of breeding activity occurred on May 11 with 23 adults observed (16 male, 7 female). Ten egg masses were deposited, resulting in approximately 15,000 tadpoles. Metamorphs were observed.

Power Alley-Power Alley was monitored at night weekly from May 11 to May 23, 2000. Additional daylight surveys were conducted throughout the summer. No adult toads were seen during monitoring. No egg masses were found. There were a few tadpoles in the upper pond and 10 to 12 metamorphs were observed.

Upper Urad-Upper Urad was night monitored from weekly from June 6 to June 14, 2000. Additional daylight surveys were conducted throughout the summer. Two adult toads were observed (1 male, 1 female). Five egg masses were deposited at this site, all fungused and died. No successful reproduction at this site in 2000.

Donut-Donut was monitored at night from May 15 to June 6, 2000. Additional daylight surveys were conducted throughout the summer. The peak of breeding activity occurred on May 23 with 11 adults (4 male, 7 female). Twelve egg masses were observed, resulting in approximately 15,000 tadpoles. Approximately 500 metamorphs observed.

Treatment-Treatment was night monitored from May 11 to May 23, 2000. Additional daylight surveys were conducted throughout the summer. Only one male was observed at this site. Two egg masses were deposited and approximately 100 to 200 metamorphs were observed.

Anne's Pond-Anne's Pond was night monitored weekly from May 15 to June 6, 2000. Additional daylight surveys were conducted throughout the summer. Five adult toads (2 male, 3 female) were observed. Three egg masses were deposited, all desiccated. No successful reproduction at this site for 2000.

Other Sites

Hassel Lake- This site is a small lake located just below timberline at the headwaters of the Woods Creek drainage. A survey was conducted on July 21, 2000, one female was observed.

Lower Urad Lake-Lower Urad Lake was surveyed on June 14, 2000. Three male toads and one egg mass were observed. No recruitment at this site in 2000.

Breeding Site Population Estimates

Boreal toads at the Urad/Henderson breeding sites were PIT tagged during 1995 to 2000 breeding site monitoring activities. Monitoring begins in mid-May and continues until no new individuals are found at each site. Males typically persist at the breeding site for several weeks after breeding activity ceases. As stated in methods, the program Capture (White et al. 1982) was used to estimate the number of males at each site for each year monitored. In 2000, the population levels dropped dramatically due to chytrid and we took actual counts at some sites.

Listed below is a brief description of each possible model selection, see White et al. 1982 for complete descriptions.

Model M_0 : Population estimation with constant probability of capture.

Model M_h : Population estimation with variable probability of capture by animal.

Model M_b : Population estimation with behavioral response to capture.

Model M_{bh} : Population estimation with behavioral response and heterogeneity.

Model M_t : Population estimation with time specific changes in probability of capture.

Model M_{th} : Population estimate under time variation and individual heterogeneity in capture probabilities.

Model M_{tb} : Population estimation under time variation and behavioral response to capture.

Model M_{tth} : Population estimate under time variation, behavioral response, and heterogeneity.

Table 5. Population estimates for male boreal toads at the breeding sites in the Urad/Henderson area from 1995 to 2000.

Site	Year	Model	Estimate	SE	95% CI
Hesbo	1995	M_{bh}	141	1.57	141 to 148
Hesbo	1996	M_b	119	4.79	114 to 134
Hesbo	1997	M_t	120	2.52	117 to 127
Hesbo	1998	M_t	120	2.73	117 to 128
Hesbo	1999	M_t	94	3.55	90 to 104
Hesbo	2000	M_t	17	<0.00	17 to 17
2 Pond	1995	M_t	32	0.95	32 to 36
2 Pond	1996	M_o	6	0.91	4 to 8
Power Alley	1996	M_{th}	61	6.72	54 to 82
Power Alley	1997	M_{tb}	80	5.10	80 to 113
Power Alley	1998	M_{tb}	80	0.66	80 to 80
Power Alley	1999	M_t	53	4.22	49 to 66
Power Alley	2000		1 ^a		
Upper Urad	1996	M_{tb}	41	0.26	40 to 41
Upper Urad	1997	M_o	34	7.59	27 to 59
Upper Urad	1998	M_h	29	5.27	23 to 44
Upper Urad	1999		9 ^a		
Upper Urad	2000		5 ^a		
Donut	1997	M_{th}	19	4.32	16 to 37
Donut	1998	M_t	44	6.29	37 to 63
Donut	1999	M_t	15	2.19	14 to 24
Donut	2000	M_o	12	8.42	7 to 51
Anne's Pond	1998	M_b	33	0.44	33 to 33
Anne's Pond	1999	M_t	26	1.79	25 to 33
Anne's Pond	2000		3 ^a		

^a Actual count

In all cases, the estimate derived from the Capture model (Table 5.) was nearly the same as the total number handled at each site indicating we had PIT tagged and handled close to the entire breeding population of males each year at each site. Based on the 1996 estimates, the male breeding population in the Henderson/Urad metapopulation was approximately 227, 233 in 1997, 306 in 1998, 197 in 1999 and approximately 38 in 2000. There was not enough tags implanted at all sites to calculate estimates, especially in 1998 when breeding occurred at a small scale at several new locations. This

type of work is critical in defining what is natural fluctuation in breeding numbers over time due to dominant year classes and identifying declines due to other causes such as disease.

PCR Sampling Results

Twenty-nine *Bufo boreas* breeding sites were visited at least once and often two or more times during the 2000 field season (Figure 1). Four of these sites did not yield any toads, so are not represented by samples. A total of 150 boreal toads were sampled at the 26 sites that produced one or more toads.

Three of the sample areas are known to be positive for chytrid fungus. That is, researchers have submitted one or more toads for pathological examination and the toads were determined to be infected. These areas are the Woods Creek drainage (Clear Creek County), North Fork drainage in Rocky Mountain National Park (Larimer County), and Conundrum Creek (Pitkin County). I obtained one or more samples from each of these areas. In addition to presence or absence of disease, it also is important to determine the prevalence of disease. Ultimately, effective management of boreal toads will require an understanding the other factors, both biotic and abiotic, that may affect the fate of a population affected by chytrid fungus.

Sites were also sampled that are not known to be positive for chytrid fungus, but are geographically proximate to positive areas. Results from these sites may provide information on chytrid dispersal. Of particular interest is information on what geographic or landscape features may constitute effective barriers to chytrid dispersal.

In addition to sampling boreal toad sites, 64 samples were collected from seven other amphibian species (Figures 2 and 3). Of these species, the northern leopard frog (*Rana pipiens*) has also experienced population declines that likely are attributable to chytrid fungus infection (Milius, 2000). Samples were collected from this species in two areas on City of Boulder Open Space.

In 1999, Woodhouse's toads (*Bufo woodhousii*) in No Thoroughfare Canyon, Colorado National Monument (Mesa County) experienced a die-off (Livo, pers. obs.). Because of the possibility that chytrid fungus might be involved in this mortality event, it was important to try to collect samples from this species. Conditions were very dry when No Thoroughfare Canyon was visited, and only one amphibian (a canyon treefrog, *Hyla arenicolor*) was observed. However, samples were obtained from juvenile Woodhouse's toads from an adjacent canyon.

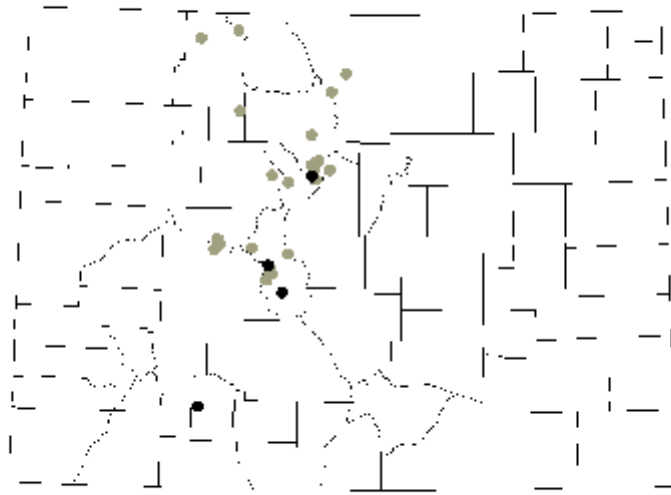


Figure 1. *Bufo boreas* breeding sites visited during 2000 (gray circles: samples collected for PCR test; black circle: site visited but no samples obtained).

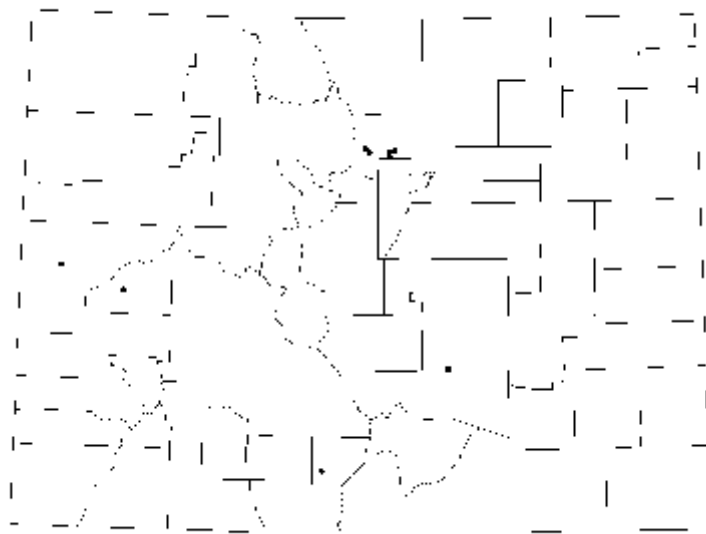


Figure 2. Non-*Bufo boreas* amphibian sites from which samples were collected for the PCR test.

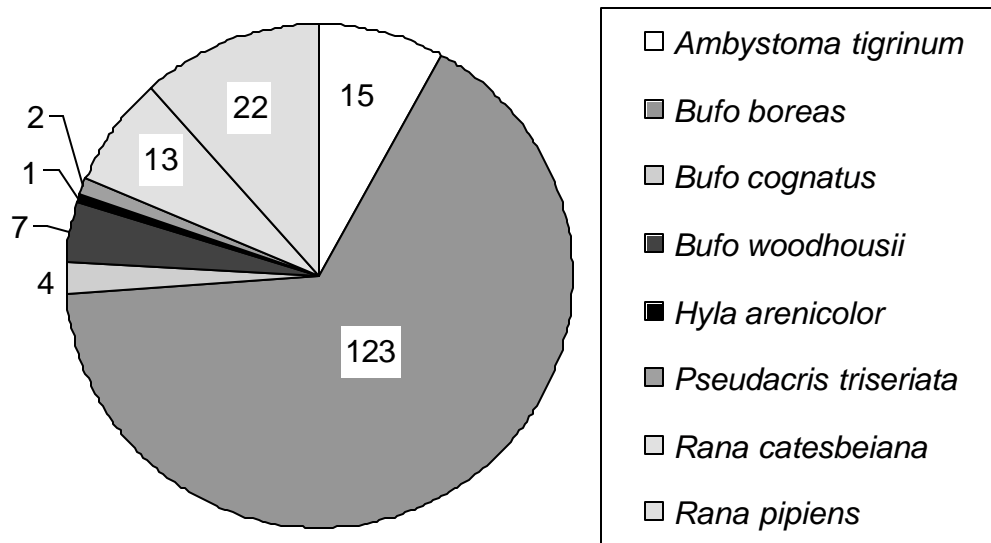


Figure 3. Species from which samples were obtained.

Other amphibian species have not experienced obvious population declines. Whether these species act as reservoirs for chytrid fungus or simply are less susceptible to infection is not known. At low elevations, non-native bullfrogs (*Rana catesbeiana*) have replaced native leopard frogs in many areas. Tiger salamanders (*Ambystoma tigrinum*) and chorus frogs (*Pseudacris triseriata*) occur in the mountains of Colorado, but unlike the boreal toad, have not experienced detectable contractions in geographic distribution. Most of the tiger salamanders were sampled from the Grand Mesa, an area proposed as a potential restoration site for boreal toads.

A limited samples of local amphibians were also collected in the vicinity of the John W. Mumma Native Aquatic Species Restoration Facility in Alamosa. Because this hatchery is the site for rearing of boreal toads, it is important to learn whether chytrid fungus is present in the area.

The sampling efforts described here cannot be analyzed until the completion of the PCR test. However, when complete, the results will provide important information on the distribution of chytrid fungus in Colorado. Future management efforts for the boreal toad will require a better understanding of the chytrid fungus, its ecology, and its effects on amphibian populations.

Prepare Publications- publications submitted during this reporting period.

Carey, C., P. S. Corn, M. S. Jones, L. J. Livo, E. Muths, and C. W. Loeffler. In press. Environmental and life history factors that limit recovery in Southern Rocky Mountain populations of boreal toads (*Bufo boreas*). In: Status and Conservation of US Amphibians. M. J. Lannoo (ed.).

Jones, M. S. and L. J. Livo. Submitted. Improved Waistband Attachment of Radio Transmitters for Toads. Herpetological Review.

Jones, M. S. and L. J. Livo. Submitted. Boreal Toad (*Bufo boreas*) Overwintering Site Selection in Colorado. Journal of Herpetology.

Technical Assistance

Death Kits

To enhance the chances of collecting at least some evidence of amphibian mortality events, we developed a self-contained "amphibian death kit" intended for use by field personnel associated with the Boreal Toad Recovery Team. The kit contains the necessary materials to make an initial collection of at least a small number of specimens (plastic storage bag for kit, plastic jar sized for specimens likely to be encountered, glass jar with formalin, clear plastic and paper stick-on labels, disposable gloves, whirl paks to freeze samples, pencil, sanitizing t

Consultations

1. Henderson Mine Candidate Conservation Agreement with Assurances

On June 17, 1999, the U.S. Fish and Wildlife Service (Service) and National Marine Fisheries Service jointly issued a Final Policy for Candidate Conservation Agreements with Assurances (CCAA's or Agreements) under the Endangered Species Act of 1973, as amended (64 FR 32726). The Agreements are intended to provide landowners incentives to promote implementation of voluntary conservation actions for proposed and candidate species, or those species that are likely to become candidates or proposed species. Ultimately, these Agreements will preclude or remove the need to federally list a species should all necessary property owners enter into Agreements.

During this reporting period we have been assisting Henderson Operations to write and implement a CCAA between the Climax Molybdenum Company, Colorado Division of Wildlife and U. S. Fish and Wildlife Service (USFWS). At this point the agreement is still in draft format and still under review by the USFWS. A copy of the draft is included in Appendix C. to serve as a model for other members of the Recovery Team or private landowners interested in this concept to 1) see what a CCAA is, and 2) offer a working structure for future agreements. It should be remembered that this agreement is still in negotiation.

2. Henderson Mine 404 Mitigation

3. Colorado's Ocean Journey

We continue to assist Colorado's Ocean Journey (COJ) in maintaining a boreal toad display at their facility. During this reporting period we worked with COJ, CSU Veterinary Teaching Hospital, and Dr. Allan Pessier to determine the causative agent involved in the illness of several of their toads. We are still working to resolve this situation.

4. Powder Horn Ski Area Expansion

During this reporting period, the principal investigator reviewed and commented on plans for future expansion of the ski area. Although no boreal toads are known to still exist on the Grand Mesa, suitable habitats within the project area were identified and recommendations to reduce conflicts with possible future translocations were discussed.

5. Black Hawk Tunnel Project

Plans for a proposed tunnel from I-25 to Hwy 119 near Black Hawk were reviewed for any potential conflicts with known boreal toad breeding locations. Several wetlands in the project area were surveyed and comments forwarded to the consulting firm conducting the study.

6. Proposed I-70 Corridor Expansion

Information was forwarded to a Consulting firm working for CDOT (J. F. SADO & Assoc.) on several potential conflicts which may impact the project as proposed. The Recovery Team actively monitors three breeding sites within the project boundaries. These consultations will be ongoing if the project is funded.

Acknowledgments

This research was funded by the Colorado Division of Wildlife and Great Outdoors Colorado. We thank personnel at Colorado National Monument, Boulder County Open Space, and City of Boulder Open Space for permission to collect samples from amphibians on their lands. Seanna Annis was instrumental in developing and providing the buffers necessary to store the samples. Several people assisted with field work at one or more sites, including Megan Battles, Steve Brazier, Nick Brummett, Cindy Carey, Mindy Clark and her YNR crew, Tom Erps, Kathy Foster, Lauren Golten, Andy Holland, Greg Horstman, Brad Lambert, Chuck Loeffler, Jenn Logan, Erin Muths, Tawnya Norton, Angie Peace, Amy Poole, Suzanne Rittmann, Rick Scherer, Bud Stiles, Steve Wilcox, and Todd Wilcox.

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APPENDIX A

Breeding site water quality results for 1997 to 2000.

APPENDIX B

SAMPLES COLLECTED FOR PCR ANALYSIS IN 2000.

Appendix C

Draft Candidate Conservation Agreement Between Climax Molybdenum Company, Colorado Division of Wildlife, and U.S. Fish and Wildlife Service.

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**CANDIDATE CONSERVATION AGREEMENT
WITH ASSURANCES**

FOR THE BOREAL TOAD

BETWEEN

CLIMAX MOLYBDENUM COMPANY

COLORADO DIVISION OF WILDLIFE

AND

U.S. FISH AND WILDLIFE SERVICE

DRAFT February 2001

CANDIDATE CONSERVATION AGREEMENT WITH ASSURANCES

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CANDIDATE CONSERVATION AGREEMENT WITH ASSURANCES

FOR THE BOREAL TOAD

BETWEEN

CLIMAX MOLYBDENUM COMPANY

COLORADO DIVISION OF WILDLIFE

AND

U.S. FISH AND WILDLIFE SERVICE

I. Introduction

On June 17, 1999, the U.S. Fish and Wildlife Service (Service) and National Marine Fisheries Service jointly issued a Final Policy for Candidate Conservation Agreements with Assurances (CCAAs or Agreements) under the Endangered Species Act of 1973, as amended (64 FR 32726). The Agreements are intended to provide landowners incentives to promote implementation of voluntary conservation actions for proposed and candidate species, or those species that are likely to become candidates or proposed species. Ultimately, these Agreements will preclude or remove the need to federally list a species should all necessary property owners enter into Agreements.

Once common in the southern Rocky Mountains, the boreal toad has experienced dramatic declines in population over the past 15 to 20 years. Reasons for declines have not been definitively identified, and may be various, including effects of acidification of water, effects of heavy metals and other toxins in waters, new or more virulent strains of pathogens, habitat disturbance, or a combination of factors, leading to stress-induced immunosuppression, and, hence, increased susceptibility to naturally occurring pathogens. Recent developments point strongly toward pathogens, specifically a species of chytrid fungus (*Batrachochytrium dendrobatitis*) – as being a major causative agent in declines of certain species of amphibians, including the southern Rocky Mountain boreal toads.

The boreal toad is presently listed as an endangered species by both Colorado and New Mexico, and is a protected species in Wyoming. The U.S. Fish and Wildlife Service has classified the southern Rocky Mountain population of the boreal toad as a candidate species which is “warranted but precluded” for federal listing – meaning that there is adequate justification and information to warrant federal listing as threatened or endangered, but listing has been postponed, as there are presently other species in greater need of listing, and the U.S. Fish and Wildlife Service has limited resources to prepare and process listing packages.

Pursuant to the listing of the boreal toad as endangered in Colorado, a recovery plan for the boreal toad was developed by the Colorado Division of Wildlife (CDOW) in 1994 (revised 1997), and an interagency recovery team was formed that same year. In 1998, the existing Recovery Plan was updated and combined with an existing draft Conservation Strategy to create a comprehensive *Boreal Toad Conservation Plan and Agreement* (Conservation Plan) for the southern Rocky Mountains. As part of the conservation planning process, Conservation Agreements have been signed by eight involved state and federal agencies and by the Colorado Natural Heritage Program, outlining and confirming their respective roles in implementing the Conservation Plan.

The recovery criteria and conservation actions described in the Conservation Plan helped form the population and habitat conservation goals and conservation measures in this Agreement. The conservation goals are the minimum population level and habitat characteristics to be maintained on Climax’s Henderson Mine and Urad properties covered in this Agreement.

Since 1995, Climax and the CDOW have been signatories to an MOU. This MOU allows the CDOW and other cooperating agencies on the Boreal Toad Recovery Team access to the boreal toad breeding sites located at Henderson Mine and Urad. By signature of this Agreement, Climax Molybdenum Company (“Climax”) enters into an Agreement for the Henderson Mine that Climax operates in Clear Creek County, Colorado, and for the reclaimed Urad Mine that Climax owns in Clear Creek County, Colorado. These two properties will be referred to collectively as the Henderson Mine and Urad. The Henderson Mill property in Grand County, Colorado, will be discussed later in this document.

II. Habitat Requirements

The southern Rocky Mountain population of boreal toads occupy forested wetland and upland habitats between 7,500 feet and 12,000 feet. Forest types consist of lodgepole pine or spruce-fir forests. A few toads have been found in ponderosa pine and willow/sage communities at their lower elevational limits.

Habitat for the boreal toad can be divided into three types: breeding, summer (juvenile and adult), and over-winter habitat. Based on research in Colorado, all three habitat types are variable indicating flexibility in habitat requirements by the boreal toad. Breeding habitat may consist of anything from a puddle in the road to a warm bay in a lake or reservoir. Eggs are often laid on the northern shore of water bodies; likely as a result of higher water temperature due to southern exposure to the sun. The key to successful breeding habitat is the availability of warm shallow water and water level stability through October. Riparian habitats are used sporadically by adults during the summer and riparian vegetation is important to toadlet survival following metamorphosis. Metamorphs must have vegetative protection to successfully disperse and seek out overwinter locations their first year. In locations without riparian vegetation the metamorphs often form post-metamorphic aggregations and eventually freeze or desiccate.

If the toads successfully metamorphose and overwinter the first year they generally disperse to upland montane habitats where they seek out spring seeps and underground burrows where they remain until they reach sexual maturity and return to breed. Similarly, adult boreal toads seek out upland habitats where they spend most of the summer and hibernate. Hibernacula generally consist of ground squirrel burrows or holes under stream banks where they can maintain temperatures above freezing through the winter. Often the hibernacula are within 800 yards of breeding sites, especially for males. The male boreal toads of breeding age return to the same site each year whereas female boreal toads may only breed once or twice in their lifetime.

III. Existing Conditions

The Henderson Mine and Urad are located west of Empire, Colorado, at an elevation range of 10,000 to 10,500 feet. The Henderson Mine and Urad, which are adjacent to each other, encompass a total of 2,897 acres.

Figure 1 (with inset) illustrates the approximate location and habitat of the Henderson Mine and Urad. The Henderson Mine is operated by Climax in accordance with a reclamation permit from the Colorado Department of Natural Resources, Mined Land Reclamation Board. The reclamation permit is current and in compliance with Colorado Division of Minerals and Geology, Office of Mined Lands, Minerals Program Rules and Regulations. Urad was operated by Climax between 1967 and 1974 prior to the Colorado Mined Land Reclamation Act and was closed and reclaimed voluntarily in the 1970s. Surface disturbance at the Henderson Mine is approximately 121 acres. At the mine site, it is unlikely that there will be any additional disturbance. The only current activity at Urad is the operation of a water treatment plant to treat seepage from the two Urad tailings facility and water generated in the dewatering of the Henderson Mine. The Henderson Mine has been in operation since 1976 and has an approximate mine life of an additional 20-25 years.

For the purposes of this Agreement the sites are divided into three categories of land use. These categories are:

- Disturbed Land
- Undisturbed Land
- Reclaimed Land

Disturbed land is the land temporarily disturbed by the Henderson Mine during the mine life. Undisturbed land is that land which has not been and will not be disturbed by Henderson Operations. Reclaimed land is land disturbed by Henderson Operation activities and later reclaimed. All disturbed land will be reclaimed under the terms of the

reclamation permit (CMLRB Permit #M-77-342). No additional reclamation activities are planned or required by permit at Urad. However, a wetlands mitigation plan has been submitted and approved by the U.S. Army Corp of Engineers to enhance an earlier wetlands mitigation project at Urad (Corps File No. 199280323). The original project was completed in the early 1990's and does encompass a large portion of the boreal toad habitat at Urad. The original mitigation plan called for the creation of 2.15 acres of wetlands. This plan was to offset wetland disturbances from the construction of a water collection system designed to eliminate water quality impacts to Woods Creek from the Urad tailings. However, due to several problems that won't be discussed here, only 0.48 acres of wetlands were successfully created during the original project.

The revised mitigation plan, submitted to the Corps on October 30, 2000 and accepted later that year, seeks not only to fulfill the original wetland requirements, but also to work cooperatively with the SERVICE and DOW to accomplish this task while improving boreal toad habitat. Many improvements can be incorporated into the wetlands mitigation plan to enhance breeding and winter/hibernation habitat for the boreal toads. See the revised mitigation plan for further details in Appendix A.

The Henderson Operation's boreal toad breeding locality consists of numerous ponds and wetlands in an area that has been heavily disturbed due to molybdenum mining by Climax. The specific breeding sites at this locality have been designated as follows: Power Alley, Hesbo, Treatment Pond, Donut, Anne's Pond, and Upper Urad. All breeding locations except for Power Alley exist on land previously disturbed in some way by mining activity. None are fed by treated or untreated process water. See Appendix B (pg. 79-84) in the April 2000 *Colorado Division of Wildlife Boreal Toad Research Progress Report, 1999* by Mark S. Jones for water quality data at these breeding sites. Figure 1 illustrates the approximate location of the existing breeding sites and other habitat at Henderson Operations.

Hesbo and 2-Pond were the main breeding locations in 1995 and 1996. Hesbo was the primary breeding site from 1997 to 1999. In 1995 and 1996 both sites were influenced by pretreated mine effluent running through them at an elevated temperature of 19-21 °C. Climax finished a new water treatment facility on the Urad side of the facility in 1997. As a result, 2-Pond is no longer an active breeding site and Hesbo has reduced water temperatures in the spring and no long term source of water. As a result of the water supply changes to Hesbo, water was pumped to the site weekly during the summers of 1998 and 1999. In an attempt to remedy this situation, Henderson Operations provided a backhoe to install a dam and water control structure to increase the depth of the channel in October 1998. Anne's Pond was also modified in 1998. The Hesbo modifications worked well in 1999 but Anne's Pond continued to dry up quickly. Even though Hesbo has the largest population of breeding adult toads, this site had no recruitment from 1995 to 1997. In 1998 and 1999, Lauren Livo removed Dyticid beetle larvae as part of her research, which resulted in substantial survival to metamorphosis in both years.

Power Alley is a beaver pond complex along the West Fork of Clear Creek and is the most natural breeding site in the area. It is not directly influenced by mine effluent and therefore the water temperature is colder than the previously mentioned sites and breeding occurs one to two weeks later. This site, however, has dried up during the last three years and desiccated the egg masses present.

Treatment pond is a man-made wetland complex that is dissected by the Urad Mill Road located north of the water treatment facility. Breeding activity is restricted to the pond(s) on the west side of the road. It does not have a large number of adults during breeding season but produced 10,000-15,000 toadlets each year from 1996 to 1999. Recruitment at this site is low as there is minimal overwinter refuge for toadlets.

Donut is a newer pond above the water treatment facility that serves as a catch basin for some of the upstream runoff. This site typically has 5-6 egg masses but because it is higher in elevation than the other sites, breeding occurs later making weather conditions post metamorphosis critical to toadlet survival and dispersal. In addition, there are few suitable hibernaculum close to this site. All toadlets froze in 1995 and 1996. We believe some toadlets survived in 1997. Survival of toadlets was good in 1998 and 1999, presumably a result of increased vegetation and small mammal burrows on the islands.

Anne's Pond is a small wetland area south of Donut that is fed by ground water and runoff. Because the average depth is less than 10 cm, the water temperature stays warm and tadpoles grow quickly. In 1996 this pond had several thousand tadpoles but dried up in July. At the request of the DOW, Henderson Mine personnel put in a water

supply pipe to keep the water level constant, which resulted in successful recruitment in 1997 and 1998. In October 1998, a backhoe was utilized to increase the main channel depth and a side channel was added. Both of these features drain to a deep-water thermal refuge. As a result of water levels decreasing too quickly in 1999, all egg masses desiccated.

Upper Urad is a large, man-made wetland area at the west end of the valley at an elevation of 10,500 feet. Due to the elevation, this is the last site for breeding activity each year. It produced toadlets in 1995 and 1996 but they froze in 1995 and were eaten by sandpipers in 1996. No successful reproduction occurred at this site from 1997 to 1999.

Research in this geographical area to date has focused on habitat and hibernacula use, toad movements, and population structure and dynamics. Boreal toad breeding at Henderson Operations usually begins around the second week of May each year at the lower elevation sites and progresses into June at the higher breeding sites. **All of the habitat preference work completed thus far by Mark Jones indicates a summer preference for rock/grass areas (primarily in reclaimed areas). Research also indicates that the man-made breeding sites have always been more successful than Power Alley, the one natural site. The limiting factors of all breeding sites are listed in the April 2000 Colorado Division of Wildlife Boreal Toad Research Progress Report, 1999 by Mark Jones under the site descriptions and background section on pages 1-2. In summary, Hesbo and Anne's Pond lack stable water, Power Alley lacks stable water due to beavers, Treatment lacks protection for metamorphs and hibernaculum for metamorphs, while Donut is very close to optimum - could use a little better protection for metamorphs. Again, reference the above-mentioned report by Mark S. Jones, Table 5 on page 21 for the latest population estimates. Although the models have not been run for 2000 yet, the numbers will be less than 50 breeding males.**

Reproduction and survival through 1999 [put in 2000 figures] appeared to be adequate to sustain the population and, in fact, this population was one of two on the Front Range that qualified as a viable population under the Conservation Plan. Despite the reproductive success and viability of this population, all breeding locations at Henderson Operations have some aspect that is sub-optimum. For example, the lack of a stable water supply at Anne's Pond and Hesbo throughout the summer frequently causes egg masses to desiccate as the pools dry up. Treatment Pond has had successful reproduction and metamorphosis since at least 1995 but lacks overwinter refugia and, therefore, does not recruit. Problems with the remaining sites are listed in the previously paragraph. Very good summer and over-winter habitat appears to exist over the rest of the undisturbed and reclaimed land areas at the Henderson Operations. Riparian vegetation only occurs around Power Alley, Hesbo, Donut, Lower Urad Reservoir, and the Upper Urad Wetlands. The newly revised wetlands mitigation plan with the Corps should increase riparian vegetation around Treatment and Donut Ponds, as well as add a new breeding site to the area known as the Main Depression. See Appendix A for further plan details.

IV. Conservation Goals Agreed to be Maintained

The following conservation goals are the minimum population level and habitat characteristics agreed to be maintained by Climax. It is hoped that conservation measures will increase the population and acreage of habitat types above these goals. There are three habitat conservation goals agreed to be maintained. It is intended that these habitat conservation goals will be achieved within three years and maintained in perpetuity or until the boreal toad no longer requires State or Federal protection. The first is to maintain six breeding ponds of at least 10 feet in diameter. The ponds will be maintained in a condition no worse than they currently exist in with a good faith effort to improve their conditions and to maintain a stable water supply to them. All suitable breeding sites at Henderson are currently being utilized. The same conditions shall apply to any breeding and/or winter hibernation sites that are developed through the revised wetlands mitigation plan with the Corps. The second habitat goal is to maintain 2.15 acres of riparian habitat at Henderson Operations. Similar goals for the Henderson Mill will be established later after an evaluation has been completed and an agreement to introduce boreal toads has been reached. The third habitat goal is to maintain all existing hibernacula within 800 yards of breeding ponds at Henderson Operations. Henderson will encourage the production of hibernacula by adding root balls and soil adjacent to breeding ponds during the Corps mitigation work, but cannot be held accountable for work that can only be accomplished by small mammals. No conservation goal will be established for upland habitat as it is abundant and not a limiting factor for toad survival.

Due to an uncontrollable decrease of toads from chytrid fungus or other diseases it may be difficult to maintain the Henderson/Urad breeding locality (and Henderson Mill if established then stricken with disease) even with suitable habitat conditions. However, as a goal, Climax agrees to maintain a population of 20 breeding adults. This goal is

based on Recovery Team objectives and, without a major die-off from chytrid fungus or other diseases, should be attainable and should provide for recovery if other populations throughout the range are maintained at viable levels. Population monitoring will continue to play an important role in tracking and researching the chytrid fungus and determination of recovery objectives.

V. Conservation Measures Agreed Upon

Conservation measures in this Agreement will support the habitat conservation goals and are compatible with suitable habitat described in the Conservation Plan. If measures attributable to land management actions, do not maintain or increase the boreal toad population then additional conservation measures may be added to the Agreement or existing conservation measures altered with agreement of Climax. New or altered conservation measures will be developed by using the most up-to-date information and will be developed in cooperation with parties to this Agreement and members of the Boreal Toad Recovery Team. The following conservation measures should achieve the population and habitat conservation goals for the Henderson Operations covered under this agreement. Conservation measures, expected implementation dates, expected costs, and parties carrying out the measures [etc.] are identified in the Implementation Schedule in Appendix D.

Climax will incorporate terms of the 1998 MOU with CDOW [See Appendix E] into this Agreement, to allow access by CDOW and others to the non-industrial areas of Henderson Operations. Continuation of access will allow collection of environmental samples for the continued evaluation of disease, habitat, hibernacula, toad movement, and population structure and dynamics. However, access to the industrial area has been limited to date to assure that all Mining Safety and Health Administration (MSHA) training requirements have been met for all CDOW employees entering the property. Although few, there have been toad sightings on industrial areas.

Translocation of boreal toads to the Henderson Mill may proceed if and when approved by the Boreal Toad Recovery Team and Climax. If translocation occurs, this Agreement shall be amended to include the Henderson Mill and to set conservation measures and population goals specifically for the Mill. Such introduction will depend on a determination that it is consistent with the Boreal Toad Conservation Plan and would not result in harm to Climax and potential future land uses. Since tailings deposition occurs at the mill site, there will be on going land disturbance at that property. Minimal future impacts are anticipated at the mine property during the life of Henderson.

Climax will, under the direction of the CDOW and recommendations of the Recovery Team and Conservation Plan, and within the restrictions of water rights, make improvements to the breeding sites identified as Anne's Pond and Hesbo. Improvements will be directed towards sustaining a sufficient water supply to the sites from May to October, as water is only critical during breeding, to attempt to prevent desiccation of the egg masses and tadpoles. Pumping water, installing permanent supply pipes and/or other options will be considered to maintain the water supply. Improvements at other existing breeding ponds as recommended by CDOW and the Recovery Team will be considered by Climax. Evaluation of water management needs for the Henderson Mill area will be determined when and if translocation is agreed upon.

Treatment Pond recruitment problems will attempt to be addressed by providing-artificial hibernacula through placement of logs, root wads, rocks, boring of holes or other methods. Three to five hibernacula will be created per acre. Little research has been done on creation of artificial hibernacula so this will be an experiment requiring monitoring. The Recovery Team should review the monitoring methodology. Artificial hibernacula may be created around Donut and Anne's Pond where the upland or riparian habitat has been disturbed if this process is successful around Treatment Pond.

Based on the approved Revised Mitigation Plan with the Corps, riparian habitat will be increased to 0.22 acres around Constructed Pond (Donut Study Site), 0.49 acres around the Main Depression (Donut Study Site), 0.15 acres around the Catchment Basin (Donut Study Site), and 1.05 acres around the Tailings Wetlands (Treatment Pond area) for a total of 2.15 additional acres of riparian habitat.

Existing breeding sites will only be disturbed to mitigate sub-optimum conditions as mentioned above.

VI. Expected Conservation Benefits

1. The conservation measures will maintain stated habitat conservation goals that, in turn, will maintain a viable population into the future, or opportunity for a viable population into the future should disease temporarily suppress the population.
2. Suitable habitats identified herein which currently exist at the Henderson Mine and Urad will be maintained.
3. Continued access by Recovery Team personnel will provide a location to study the chytrid fungus and its effect on boreal toads.
4. Based on the recommendations of the Recovery Team, the CDOW, and USFWS, Climax may allow for future translocation to the Henderson Mill to preserve existing genetic stock and to potentially create another breeding locality and viable population. However, only if such translocation will not interfere with Climax's ability to operate the Henderson Mill.

VII. Assurances Against Future Regulation

Should the boreal toad become federally listed, additional conservation measures other than those identified herein will not be required and additional restrictions will not be imposed by the Service on their own accord or through consultation on future environmental permits. Authorization for incidental take back to levels consistent with the habitat and population conservation goals are disclosed in the section 10 (a) (1) (A) Enhancement of Survival Permit attached as Appendix F.

In addition, the USFWS and CDOW recognize that Climax secures water for its Henderson Operations through specific rights and decrees. That water may be used and diverted for its operations in accordance with those rights and decrees and further that such rights and decrees may limit Climax's ability to carry out certain enhancement projects or recommended actions. Likewise, existing and future environmental or reclamation permits regulating the Henderson Operations may preclude Climax from undertaking certain enhancement projects or recommended actions.

VIII. Habitat and Population Monitoring and Reporting

Habitat monitoring will be conducted by CDOW annually the first five years to determine if progress towards, and maintenance of, habitat goals are being achieved. Once habitat goals are achieved, monitoring will take place every three years until it is determined that the boreal toad no longer requires State or Federal protection. Monitoring of breeding pond water maintenance will only require ocular observation by CDOW, Climax, or other researchers every month from May to October or whenever water management changes are made. Upland habitat monitoring will not be required beyond visual observations as upland habitat is not a limiting factor. Riparian habitat monitoring will require length and width measurements of major habitat types and a species inventory. Hibernacula monitoring will require specific mapping and marking of artificial and natural hibernacula. Determination of artificial hibernacula use will occur through radio tracking, ocular observation, manual search with hands or nets, optic cable video-camera, or a combination of the above. Population monitoring will take place annually by the CDOW at Henderson Operations and the Henderson Mill site when and if translocation is conducted. Standardized breeding site monitoring will be conducted as specified in the Boreal Toad Conservation Plan. Monitoring of compliance with this Agreement will take place by the Service through annual reports, due December 31st of each year, and site inspections coordinated with Climax and CDOW when necessary.

IX. Notification of Take

Before any action that may incidentally take boreal toads occurs on the property, Climax shall notify the Service or the CDOW, so the agencies will be afforded a reasonable opportunity to rescue individual specimens of boreal toads before any authorized incidental taking occurs.

X. Transfer of Benefits

The benefits of this Agreement shall transfer automatically to any subsequent owner of the property. However, any subsequent owners must obtain a new section 10(a)(1)(A) permit since these are non-transferable in accordance with 50 CFR part 13.25. Climax agrees to notify the Service upon any transfer of land under this Agreement.

XI. Funding of Conservation Measures

Where appropriate, Climax may provide assistance at the site using existing personnel, equipment and facilities and, where appropriate will cooperate in efforts to secure funding for the recommended activities. The CDOW will provide funding and personnel for many of the management activities, research on chytrid fungus, habitat, and population monitoring. It is expected that supplies, equipment, and staff time for habitat conservation measures will cost \$5,000 per year for Climax and approximately \$35,000 per year for the CDOW. Staff time is expected to be 100 hrs/year for Climax employees and 250 hrs/year for CDOW employees. CDOW funding will likely come from Go Colorado (GOCO). The Service may be able to provide funding through the Partners for Fish and Wildlife Program, Endangered Species Act section 6 funds provided to the States (CDOW), or through the Landowner Incentive Program. Staff time for the Service is expected to be 24 hrs/year for review of conservation actions and compliance with the Agreement

XII. Duration of Agreement

This Agreement will remain in effect until the boreal toad no longer has a special designation under State and Federal species lists.

XIII. Termination of the Agreement

Should Climax wish to discontinue this Agreement they may do so at any time by providing written notice to the Service.

Appendix A

Revised 404 Mitigation Plan

(To be supplied by Climax)

Appendix B

Boreal Toad Research Progress Report, 1999 Mark S. Jones, Editor

(To be supplied by CDOW)

Appendix C

Finding of the Benefits of the Conservation Measures

The Service finds that the benefits of conservation measures implemented by Climax at its Henderson Operations, when combined with those benefits that would be achieved if it is assumed that conservation measures were also to be implemented on other necessary properties, would preclude or remove any need to list the boreal toad. The conservation measures should maintain habitat goals possible for continued support of a viable population. Barring further declines by the chytrid fungus, the conservation measures should maintain or increase the number of adult toads observed there in recent years. The population conservation goal of 150 adult toads is much greater than the minimum number considered a viable population in the Conservation Plan but should be attainable barring sustained declines by the chytrid fungus or other diseases. It is hoped that, at a minimum, the population will be maintained over a five year period and will maintain an average total of at least twenty (20) breeding adults producing an average of four (4) viable egg masses per year in concert with the second definition below of a viable population. All known habitat and environmental threats, under control of Climax, would be removed from the Henderson Operations' toads through this Agreement.

Recovery Objectives and Status

The objectives of the management and conservation actions outlined in the *Boreal Toad Conservation Plan and Agreement* and in this Candidate Conservation Agreement are to (1) prevent the extirpation of boreal toads from the area of their historic occurrence in the southern Rocky Mountains. This area includes eleven mountain ranges or geographic areas, covering southern Wyoming, much of Colorado, and a portion of northern New Mexico and (2) to avoid the need for federal listing of the boreal toad under the ESA, and (3) to recover the species to a population and security level that will allow it to be de-listed from its present endangered status in Colorado and New Mexico.

The present recovery objectives and criteria are based on objectives for boreal toad recovery formulated and previously approved by the interagency Boreal Toad Recovery Team in Colorado's *Boreal Toad Conservation Plan and Agreement*. The Colorado Division of Wildlife has already adopted these criteria and is pursuing conservation actions described in this plan for recovery of the boreal toad in Colorado. Should federal listing of this species occur, these criteria should be incorporated into any subsequent federal recovery plan for this species.

The following are criteria for downlisting and delisting of the boreal toad in the State of Colorado

To downlist from "endangered" to "threatened", there must be at least two (2) viable breeding populations of boreal toads in each of at least six (6) of the eleven (11) areas, or mountain ranges, of its historic distribution, AND the number of viable breeding populations throughout the historic range must total at least fifteen (15).

To delist the boreal toad in Colorado, there must be at least two (2) viable breeding populations of boreal toads in each of at least nine (9) of the eleven (11) areas, or mountain ranges, of its historic distribution, AND the number of viable breeding populations throughout the historic range must total at least twenty-five (25).

In order for a population of boreal toads to be considered "viable", it must meet the following criteria:

There must be documented breeding activity and recruitment to the population in at least two (2) out of the past five (5) years. However, if breeding activity has not been documented in the past three (3) years, there must be reliable observations of toads, including at least one sub-adult age class, in the area during at least two (2) of those three (3) years.

OR

There has been an average total of at least twenty (20) breeding adults at the breeding locality, producing an

average of at least four (4) viable egg masses per year, and the number of breeding adults observed at the locality has remained stable or increased over a period of at least five (5) years.

AND

The population faces no known, significant and imminent threat to its habitat and environmental conditions.

For the purpose of interpreting the above criteria, the following definitions will apply:

Breeding population: Toads associated with one or more breeding localities which are located within a common second or third order drainage, and separated by no more than five (5) miles (approximately 8 km).

Breeding Locality: A geographic area containing one or more breeding sites which are separated by a distance of no more than ½ mile (approximately 0.8 km).

Breeding Site: A specific location in any body of water where toads congregate to breed and deposit eggs.

Recruitment: The presence of one-year-old toads in any given year will be considered to be successful recruitment from the previous year's breeding activity.

Appendix D

Implementation Schedule

(Make one that includes actions to be taken, by whom, when, cost estimates, and any other information necessary.)

Appendix E

1998 Memorandum of Understanding between Climax and CDOW

(To be supplied by CDOW)

APPENDIX F

Enhancement of Survival Permit for Incidental Take of Boreal Toads

(To be supplied by USFWS)