

**REPORT
ON
THE STATUS AND CONSERVATION
OF
THE BOREAL TOAD
Bufo boreas boreas
IN
THE SOUTHERN ROCKY MOUNTAINS**

2005



**Prepared By The Boreal Toad Recovery Team
Tina Jackson, Coordinator/Editor**



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February, 2006

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INTRODUCTION AND SUMMARY

This is the seventh in a series of reports providing a summary of boreal toad conservation work in the Southern Rocky Mountains, and a current progress report on recovery efforts for this species.

Once common in the Southern Rocky Mountains, the boreal toad has experienced dramatic declines in population over the past 20 to 25 years. Reasons for declines have not been definitely identified, but 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 towards pathogens - specifically *Batrachochytrium dendrobatitis* (*Bd*), a species of chytrid fungus - as being a major causative agent in declines of certain species of amphibians, including the Southern Rocky Mountain boreal toads.

Research in the mid-1990s regarding the genetics of the boreal toad in the Southern Rocky Mountains has revealed that this population is a genetically unique lineage, and may warrant classification as a separate subspecies, or even a separate species, within the genus *Bufo*. Hammerson (1999) recognizes this information and suggests that *Bufo boreas* in the Southern Rocky Mountains be considered a separate species. For the purpose of this report, the names *Bufo boreas boreas*, and 'boreal toad' will continue to be used.

The boreal toad is presently listed as an endangered species by both Colorado and New Mexico, and is a protected species in Wyoming. On September 29th, 2005, the U.S. Fish and Wildlife Service announced their finding that the Southern Rocky Mountain population of the boreal toad is no longer warranted for federal listing under the Endangered Species Act. This withdrawal does not change the status of the boreal toad in any of the three states involved in this document.

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 in 1994 (revised Jan. 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 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 respective roles in implementing the Conservation Plan. No new agreements were appended to the plan in 2000. A revised and updated version of the Boreal Toad Conservation Plan was completed in 2001.

For the past nine years, the recovery team has worked on plans and actions to implement recovery and conservation efforts for the boreal toad. Work to date has involved several state and federal resource management agencies, personnel from universities, the Colorado Natural Heritage Program, and various other interested parties, including local land use planners and private land owners. Management activities to date have included (1) the conducting of surveys of historic and potential suitable habitats for new toad populations, (2) the annual monitoring of known breeding populations, (3) research work to identify and evaluate biotic and abiotic limiting factors to toad survival, (4) research to better define good boreal toad habitat and boreal toad biology/ecology, (5) development and testing of techniques and protocols for captive breeding and rearing of boreal toads, (6) experimental reintroductions of toads to vacant historic habitat, (7) protection of boreal toads and their habitats via coordination with land management agencies - in particular with the US Forest Service, (8) work with local land use planners and developers aimed at avoiding or minimizing potential impacts of private land development on boreal toads and their habitat, and (9) efforts to increase public awareness of this species and its plight via informational/educational activities and public involvement in searches for new populations of boreal toads.

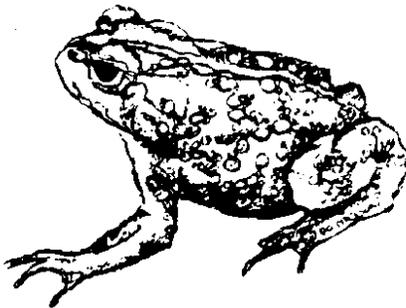
As of February 2006, the boreal toad (SRMP) is known to occur in fourteen counties (Chaffee, Clear Creek, Eagle, Grand, Gunnison, Hinsdale, Jackson, Larimer, Mesa, Mineral, Park, Pitkin, Routt, Summit) in Colorado and two counties (Albany and Carbon) in southern Wyoming. Indications are that boreal toads may also still occur in Boulder, Garfield, Gilpin, Lake, Rio Blanco, Saguache, and Conejos counties in Colorado. No confirmed reports of boreal toads have been obtained during the past two decades from Rio Arriba County, New Mexico, and it may be extirpated from that state. This is based on surveys, monitoring of breeding sites, and on confirmed or reliable observations of individual boreal toads during recent years. There are presently 71 known breeding localities - some having more than one breeding site - located in nine of the eleven geographic areas, or "mountain ranges of historic occurrence". The White River Plateau, an area of historic occurrence, has no recent confirmed records of occurrence of boreal toads, although unconfirmed sightings exist. A second area of historic occurrence, the Grand Mesa, had confirmed sightings of adult boreal toads in the past five years, but breeding localities have not been located. Based on the definition of "Breeding Population" (Loeffler 1998), the 71 breeding localities comprise 38 separate populations, of which only two (2) presently meet the criteria to be considered "viable". (See summary in Table 1). The decline in the number of "viable" populations from 1999 is due to revision of the viability criteria, and the discovery of die-offs caused by Bd in at least two of the populations which were formerly considered to be viable.

The criteria for recovery of the boreal toad in the Southern Rocky Mountains were reviewed and edited in 1998 to make them more objective and measurable, and again revised at the end of 2000 to reflect improved knowledge of boreal toad population dynamics. Due to the changes in the criteria, direct comparisons of the level of achievement of recovery goals from 1997 to subsequent years may not accurately reflect actual progress towards recovery (See "Recovery Objectives and Status", page 7). Significant progress has been made with the boreal toad recovery and conservation effort in the past nine years, and it is anticipated that much can be accomplished towards recovering this species in the next five years, provided adequate funding and personnel time is available. The recovery team recognizes that time and funding are in short supply, and will pursue innovative approaches to

accomplish needed work, including partnerships, and other cooperative efforts.

ACKNOWLEDGMENTS

The Boreal Toad Recovery Team appreciates the substantial contributions made towards the implementation of the Boreal Toad Recovery Plan by various agencies - particularly the Colorado Division of Wildlife, the USGS/Biological Resources Division, and the US Forest Service. Also appreciated is the funding which has been provided by *Great Outdoors Colorado* (GOCO) in support of the boreal toad conservation and recovery effort during the past several years, and technical assistance and advice provided by scientists from the Integrated Research Challenges in Environmental Biology - National Science Foundation (**IRCEB**) group in regard to evaluation and management of Bd.



MANAGEMENT STATUS & ADMINISTRATION

Legal Status of the Boreal Toad

The boreal toad has been state listed as an endangered species in New Mexico since 1976 and in Colorado since November, 1993. It is a protected species in Wyoming. Since 1995, the Southern Rocky Mountain Population of the boreal toad was a Federal candidate for listing as a threatened or endangered species. However, on September 29th, 2005, the U S Fish & Wildlife Service announced that listing is not warranted at this time because the Southern Rocky Mountain Population does not constitute a species, subspecies, or distinct population segment under the Endangered Species Act. As a result of the decision, the Southern Rocky Mountain Population of the boreal toad was withdrawn from the Federal candidate list. This withdrawal does not change the status of the boreal toad in any of the three states involved in this document.

The Recovery Team and Technical Advisory Group

Boreal Toad Recovery Team

The Recovery Team for the Southern Rocky Mountain Population of the Boreal Toad was formed in late 1994. Initially a loosely organized group of people from various agencies, it had been working on boreal toad issues for two to three years prior to that time. Since 1994, it has evolved into a multi-agency team, consisting of a core recovery team and a technical advisory group.

This group has primary responsibility for the development and implementation of a recovery/conservation plan, and represents all agencies which have legal responsibility and authority to implement management actions. Members of this group have the "voting" authority to make decisions and recommendations for, and to, their agencies regarding management actions. It is composed of one representative from each such agency, or in the case of the US Forest Service, one representative from each involved region. As of February 2006, the team consists of the following personnel:

Colorado Division of Wildlife	Tina Jackson, Denver, CO
New Mexico Game & Fish Department	Charles Painter, Santa Fe, NM
Wyoming Game & Fish Department	Bill Turner, Laramie, WY
US Fish & Wildlife Service	Terry Ireland, Grand Jct., CO
USGS/Biological Resources Division	Erin Muths, Ft. Collins, CO
US Forest Service (Region 2)	Doreen Sumerlin, Granby, CO
US Forest Service (Region 3)	Donna Storch, Taos, NM
NPS/Rocky Mountain National Park	Therese Johnson, Estes Park, CO
Bureau of Land Management	Jay Thompson, Lakewood, CO
Environmental Protection Agency	Ed Stearns, Denver, CO

The Recovery Team meets yearly to review and plan needed field work and other management actions. A mailing list of numerous interested parties is used to disseminate information on Recovery Team actions and boreal toad conservation efforts. Minutes of Recovery Team meetings are available upon request from the team coordinator (see below).

The Colorado Division of Wildlife (CDOW) has assumed the responsibility for leadership and coordination of the Boreal Toad Recovery Team. Contact with the Recovery Team may be made via Tina Jackson as follows:

By Mail: Tina Jackson, Wildlife Conservation Section, Colorado Division of Wildlife, 4255 Sinton Road, Colorado Springs, CO 80907

By Phone: 719-227-5237

By E-Mail: Tina.Jackson@state.co.us

Boreal Toad Technical Advisory Group

This group is composed of persons who have specialized or technical expertise and knowledge regarding the species, habitat, and/or other specific areas of knowledge which are vital to the implementation of recovery and conservation efforts. In the process of plan development, formulation of guidelines and protocols for implementation, and weighing of alternatives in decision making, this group is relied upon to help guide and advise the recovery team. As a general rule, technical/biological recommendations which represent a majority consensus of this group will be accepted and followed by the Recovery Team, unless there are overriding socio-economic and/or political factors which dictate other courses of action. The Technical Advisory Group may meet outside of the yearly Recovery Team meetings as necessary to handle relevant issues.

The present recognized composition of this group is as follows, and is open to other qualified and interested participants:

Paul Bartelt	Waldorf College, Forest City, IA
Ron Beiswenger	University of Wyoming, Laramie, WY
Cynthia Carey	University of Colorado, Boulder, CO
Steve Corn	USGS/Biological Resources Division, Missoula, MT
Jenn Logan	Colorado Division of Wildlife, Alamosa, CO
Anna Goebel	Florida Gulf Coast University, Fort Meyers, FL
Mary Jennings	US Fish & Wildlife Service, Cheyenne, WY
Kevin Rogers	Colorado Division of Wildlife, Steamboat Springs, CO
Don Kennedy	Denver Water Board, Denver, CO
Brad Lambert	Colorado Natural Heritage Program, Ft. Collins, CO
Lauren Livo	University of Colorado, Boulder, CO

Recovery and Conservation Plans

Boreal toad recovery work from 1994 through 1998 was based primarily on the Boreal Toad Recovery Plan, which was prepared by and for the State of Colorado pursuant to the listing of the boreal toad as a state endangered species in 1994 (Revised in 1997). The Recovery Team, with primary direction from the US Fish & Wildlife Service and the US Forest Service, also developed a draft Conservation Strategy, which focused on actions needed to protect and conserve boreal toad habitats on public lands - primarily US Forest Service lands.

In 1998, the Recovery Team agreed that it would be in the best interests of the recovery effort to revise and combine the State Recovery Plan and the draft Conservation Strategy into a single,

comprehensive document. Therefore, in October, 1998, the existing documents were combined in the new *Boreal Toad Conservation Plan and Agreement*. This document was revised and updated in early 2001, and provides guidance to all participating agencies in regard to management and conservation of the boreal toad and its habitat, and provides the opportunity for each agency to sign a Conservation Agreement to define and confirm its commitment to the boreal toad conservation effort. As of February, 2001, eight state and federal agencies and the Colorado Natural Heritage Program, based at Colorado State University, have signed such agreements, which are appended to the Conservation Plan. Copies of this plan are available upon request from the Recovery Team coordinator (see previous page for contact information). The plan may also be accessed via the Internet at the following address: <http://wildlife.state.co.us/Research/Aquatic/BorealToad/>.

Recovery Objectives and Status

The objectives of the management and conservation actions outlined in the Boreal Toad Conservation Plan and Agreement are to: (1) prevent the extirpation of boreal toads from the area of their historic occurrence in the Southern Rocky Mountains, which includes eleven mountain ranges, or geographic areas, covering southern Wyoming, much of Colorado, and a portion of northern New Mexico; (2) avoid the need for federal listing of the boreal toad under the ESA; and, (3) 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, revised 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 Recovery Plan*. The CDOW 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:

1. There must be documented breeding activity *and* recruitment to the population in at least four (4) out of the past ten (10) years. However, if breeding activity has not been documented in the past four (4) 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 four years.

OR

2. There has been an average observed total of at least twenty (20) breeding adults in the population, producing an average of at least four (4) viable egg masses per year, and the number of breeding adults observed in the population has remained stable or increased over a period of at least ten (10) years.

AND

3. The population faces no known, significant and imminent threat to its habitat, health, 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 (approx. 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 (approx. 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.

* * *

MONITORING & STATUS OF BREEDING POPULATIONS

Based on various historic reports and observations since the early part of the 20th century, boreal toads were considered to be fairly common in much of the Southern Rocky Mountains, from southern Wyoming to northern New Mexico. One of the earliest published reports of boreal toads in Colorado is from the Buena Vista area, in Chaffee County, where numerous toads were seen under street lights and along irrigation ditches (Ellis and Henderson, 1915). Records of boreal toad observations over the years are somewhat sparse and scattered. Most are associated with a few specific studies, such as James Campbell's work in the late 1960's and early 1970's (Campbell, 1970; Campbell, 1972).

By the early 1980s, the boreal toad was still considered fairly common throughout its known range in Colorado (Hammerson and Langlois 1981), but evidence of dramatic declines had already been noted. Carey (1993) observed the disappearance of 11 populations of boreal toads between 1974 and 1982 in the West Elk Mountains. Subsequent surveys have shown no re-colonization of these former breeding sites. Surveys of 38 historic breeding locations in eight national forests in Colorado covering Boulder, Chaffee, Delta, Gunnison, Jackson, Larimer, Mesa, and Summit counties from 1982 to 1992 revealed only one occupied site in Chaffee County (Lauren Livo, pers. obs.). In 1989, Hammerson (1989) surveyed 143 sites in the Arapaho Lakes, Big Creek Lakes, and Lone Pine Creek areas of Jackson County; 31 sites in the White River plateau within Garfield and Rio Blanco counties; five sites in the Elkhead Mountains in Moffat and Routt counties; 49 sites on the Grand Mesa including Delta and Mesa counties; and 22 sites in Chaffee, Clear Creek, Gilpin, Gunnison, and Park counties. Boreal toads were found in only two of these 250 sites, in Chaffee and Garfield counties. In 1991 Hammerson (1992) surveyed 377 sites in the following Colorado locations or river basins: Upper Alamosa, Upper Arkansas, Conejos, Upper Eagle, Grand County, Grand Mesa, Upper Gunnison, Upper Rio Grande, San Juan, San Luis Valley, Upper San Miguel, and Upper South Platte, and observed only a single population of boreal toads which was subsequently confirmed in 1992 by Livo. Corn et al. (1989) found that toads were absent from 83 percent of historic locations in Colorado and 94 percent of the historic sites in Wyoming. This represented a decline from 59 to 10 known localities from 105 sites surveyed in 1986-1988 in Boulder and Larimer Counties, Rocky Mountain National Park, and in the Park Range in Colorado, and in Albany and Carbon Counties in Wyoming. Boreal toads were thought to be extirpated from the southern periphery of their range in the San Juan Mountains in New Mexico (Stuart and Painter 1994; New Mexico Department of Game and Fish 1988), but an unconfirmed report of a sighting of one adult boreal toad and one boreal toad tadpole in September 1996 gives hope that a breeding population may still exist in New Mexico (C. Painter, unpubl. 1996).

Since the listing of the boreal toad as a state endangered species in Colorado in 1993, efforts to survey known historic and potential toad habitats, and to monitor known existing breeding populations, have been intensified. The following is a summary of what is known about boreal toad occurrence, distribution and status as of February 2006.

Breeding Populations by Geographic Area

The objectives for recovery of the boreal toad in the Southern Rocky Mountains, as outlined in the Boreal Toad Conservation Plan (1998, revised 2001), are based on the documentation and/or establishment of a certain number of secure populations within each of the "mountain ranges of its historic distribution." These are presently recognized to include the Park Range, Elkhead Mountains, Medicine Bow Range, Front Range, Gore Range, Mosquito & Ten-Mile Range, Sawatch Range, White River Plateau, Grand Mesa, Elk & West Elk Mountains, and the San Juan Mountains. The "mountain ranges of historic occurrence" are presented in this report in roughly geographic order from north to south. See Figure 1 for a map of general locations.

The borders or limits of these mountain ranges are often difficult to define precisely. For the purpose of boreal toad recovery, and for clarification, the descriptions in the following pages will serve to define these areas, and provide a brief summary of boreal toad status in each. In cases where toad populations may be found which do not fit neatly in to one of these areas, the Boreal Toad Recovery Team will make a determination as to which "mountain range of historic distribution" the population is most closely linked.

Based on the definition of "Breeding Population" (Loeffler 2001), there are presently 71 breeding localities comprising 38 separate populations, of which only two (2) presently meet the criteria to be considered "viable" (See Summary in Table 1). These populations are the Cottonwood Creek population in Chaffee County and the White Rock Mountain population in Gunnison County. The decline in the number of "viable" populations from 1999 is due to revision of the viability criteria, and the discovery of die-offs caused by Bd in at least two of the populations which were formerly considered to be viable. In most cases, breeding populations are defined such that there is normally no migration of toads between populations. However, due to the continuity of habitat, and the fact that breeding populations can occur in separate drainages which are in close proximity at their headwaters, some populations may be closer to each other than the minimum 5-mile separation, and some toads may occasionally migrate from one to the other by crossing high mountain passes. A case in point would be the Conundrum Creek population in Pitkin County and the Triangle Pass population in Gunnison County. In a straight line they are within 5 miles of each other, but they are located in different primary drainages, separated by a 12,500'+ mountain pass. Whereas these localities are in different major drainages, they are considered parts of different populations.

Monitoring in 2005 of 63 known breeding localities, indicates that 41 of the sites had breeding activity, 14 sites apparently were inactive, and 8 sites are of unknown status due to lack of adequate monitoring. Breeding activity was documented in at least 26 of the 38 known populations in 2005.

Overall, boreal toad populations showed fair to good reproduction. However, in 2005, some breeding localities remained dry or dried prior to metamorphosis due to the continuing effects of drought.

Additional testing of breeding sites for the presence of chytrid occurred in 2005. Currently, sixteen breeding sites have tested positive. The following populations contain one or more chytrid-positive

breeding localities: Big Meadow (Grand County); California Park (Routt County); Clear Creek (Clear Creek County); Clear Creek West Fork (Clear Creek County); Conundrum Creek (Pitkin County); Muddy Pass (Jackson County); North Fork of the Big Thompson (Rocky Mountain National Park, Larimer County); North Fork of the Elk River (Routt County); Pole Creek (Grand County); Snake River (Summit County); South Cache le Poudre (Larimer County); Upper Williams Fork (Grand County); and Vail (Eagle County).

The 2005 survey efforts located two previously undocumented breeding populations each consisting of one previously undocumented breeding locality. These new breeding localities are the Lincoln Creek site in Pitkin County and the Muddy Pass Lake site in Jackson County. Figure 2 illustrates current known boreal toad breeding localities as well as miscellaneous recent (1992-2005) boreal toad observations thought to be reliable.

Interpretation of Breeding Locality Tables

Locality Numbers: These are assigned chronologically to localities on a county-by-county basis. The two-letter designation indicates the county, and the number is the chronological number of the locality for that county, based on when the locality was originally found. All breeding localities within a specific county may not fall within the same geographic area or mountain range.

Locality and Population Names: After the locality number will be the name of the locality, followed by the name of the population of which it is considered a part. The population name is in parentheses, and in some cases may be the same as the locality name. In this version of the Status Report, Bd status is reported to the right of the locality and population name. Bd status may be *negative* (at least one individual tested and no chytrid-positive results obtained), *positive* (at least one individual tested positive), or *not tested* (no toads from that locality sampled). For positive sites, the year Bd was first detected at the site is reported in parentheses. For negative sites, the year of last testing at the site is reported in parentheses.

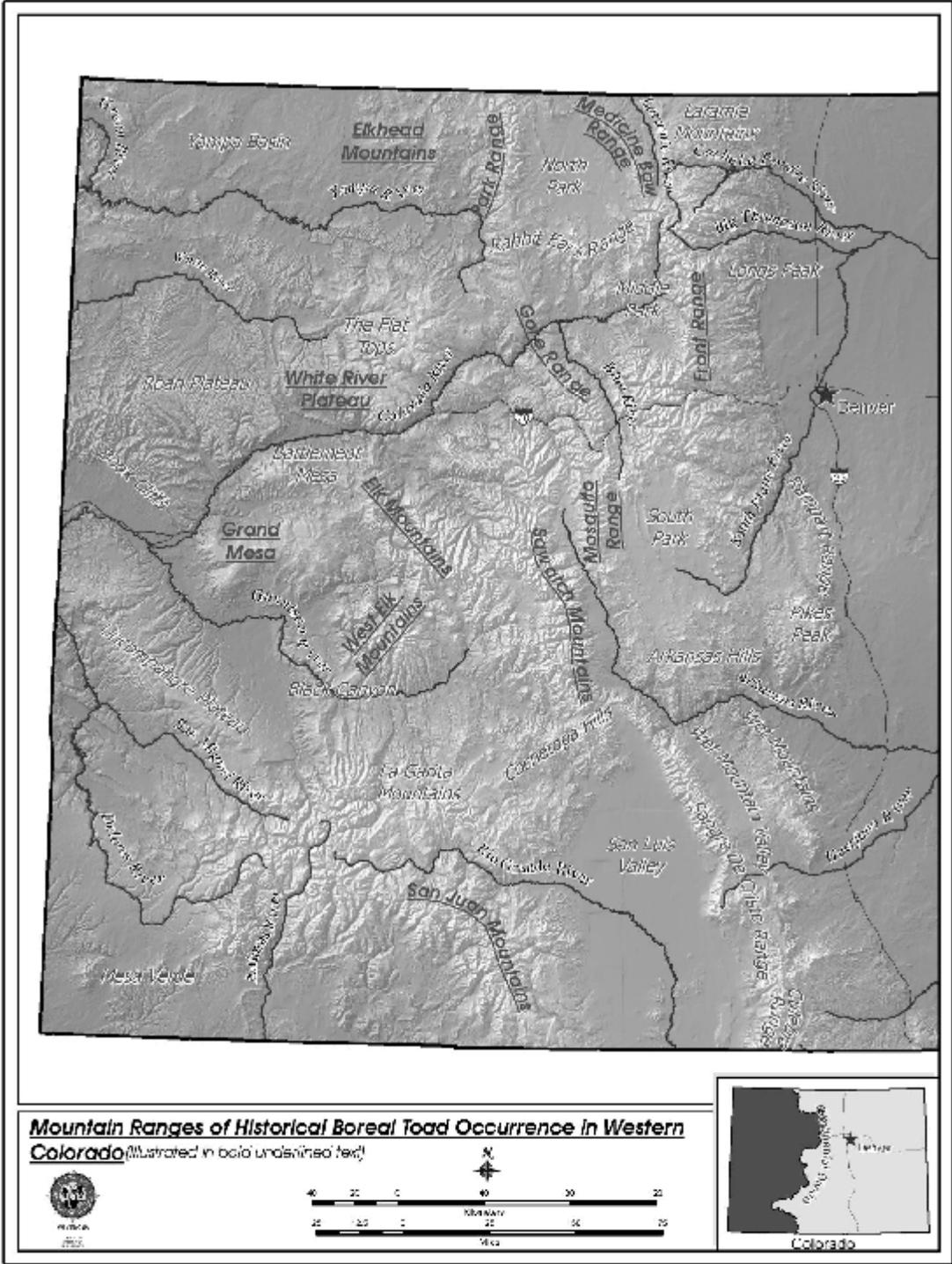
M/F/Egg Masses: This column shows the *minimum* number of breeding-age males (M), females (F), and number of viable egg masses at the locality in each year. These numbers may represent actual counts, or they may be presumed, based on other evidence. For instance, if tadpoles are observed at a locality, it is assumed that there had to be at least one adult male and one adult female present. If three separate egg masses are observed, but no adults are seen, the table will still show 3/3/3, as it is assumed that one pair of breeding toads was present to produce each of the egg masses. A question mark "?" in this column indicates that data are lacking or ambiguous. It should be noted that more intensive studies, using PIT tagging, in Rocky Mountain National Park, the Urad/Henderson Mine area, and the Cottonwood Creek drainage in Chaffee County demonstrate that standard monitoring reveals only a small proportion of adult toads actually present at a site or in a population.

Recruitment: A "Yes" entry means that one year old toadlets were observed at the site in the Spring of the *following* year, or two year old toads were seen the second year. For example; one year old toadlets in June, 1997, would indicate successful recruitment from the 1996 breeding season, and would be noted by a "Yes" entry in 1996. Therefore, all sites will, at this time, show either a "Unk"

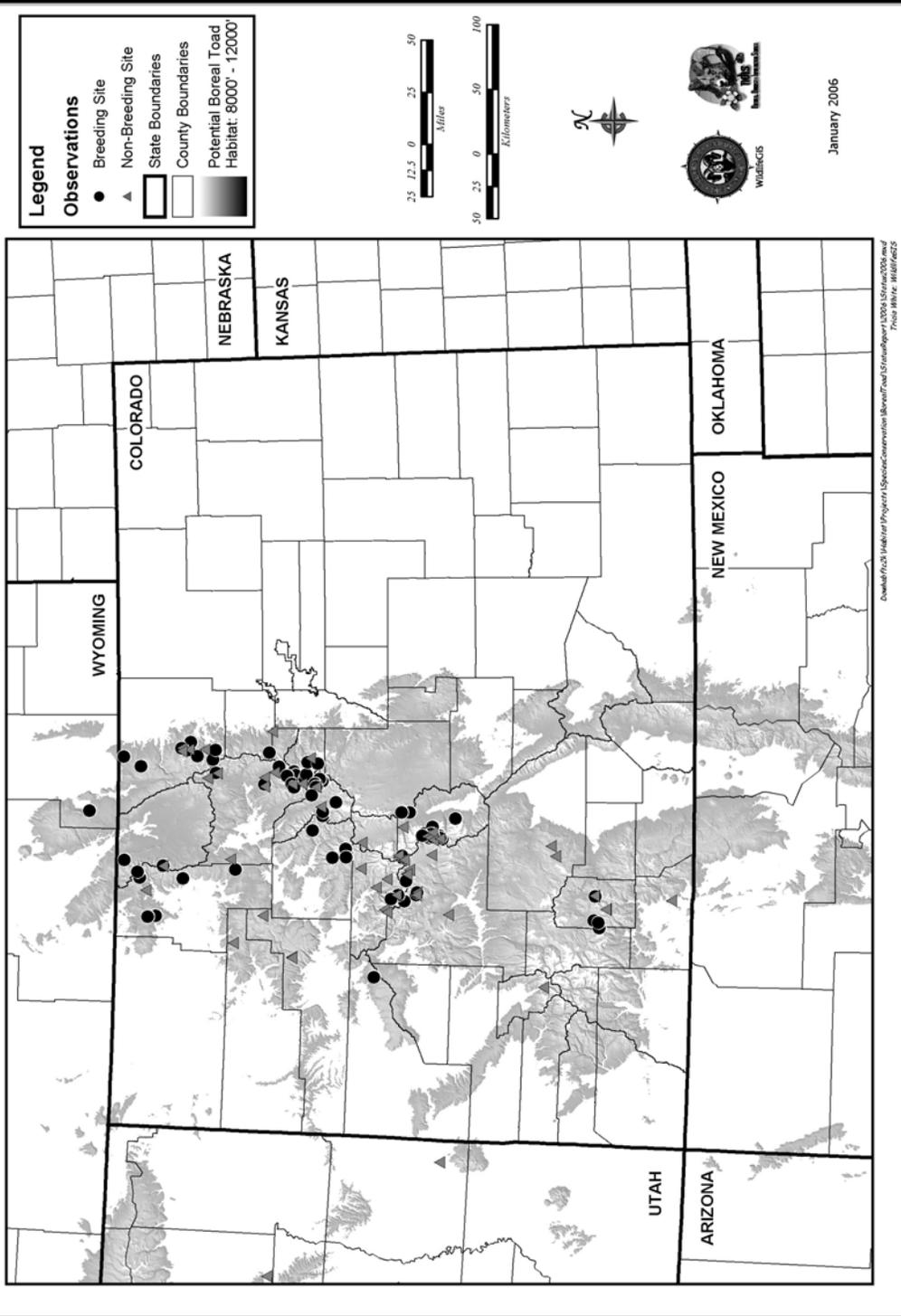
(unknown) entry or a "No" entry for 2005, as success cannot be determined until the Spring or Summer of 2006, or it is known that there were no metamorphosed toadlets produced at the site in 2005.

Age Classes: The first number in the entry indicates the minimum number of age classes observed/reported at a specific site. Numbers within parentheses indicate which age classes were observed: M = Metamorphs (young of the year), 1 = one year olds (new "recruits"), S = Sub-adults (generally two to three year old toads), 2 or 3 = Sub-adults which were specifically identified as either two or three year old toads, A = Adult toads (generally 4 years old and older).

* * *



Recent Boreal Toad Observations 1992 - 2006



Five year summary of boreal toad breeding populations in the Southern Rocky Mountains

Jan. 2006

Geographic area (Mtn. range of historic occurrence)	Number of populations	Populations w/ breeding/recruitment					Populations w/ 20+ breeders & 4+ egg masses					"Viable" populations
		2001	2002	2003	2004	2005	2001	2002	2003	2004	2005	
Park Range	4	2/1	2/1	1/1	1/1	2/?	0	0	0	0	0	0
Elkhead Mountains	1	1/1	1/1	1/1	1/0	1/?	0	0	0	0	0	0
Medicine Bow Range	1	0/0	0/0	0/0	0/0	0/0	0	0	0	0	0	0
Front Range	16	7/6	7/4	8/5	10/4	8/?	3	3	2	2	2	0
Gore Range	3	3/2	3/2	2/1	2/3	3/?	0	1	0	0	0	0
Mosquito & Ten-mile Range	2	1/1	1/0	1/0	1/1	1/?	0	0	0	0	0	0
Sawatch Range	7	5/3	5/3	5/4	5/4	5/?	1	2	1	2	2	1
White River Plateau	0	0/0	0/0	0/0	0/0	0/0	0	0	0	0	0	0
Grand Mesa	0	0/0	0/0	0/0	0/0	0/0	0	0	0	0	0	0
Elk & West Elk Mountains	3	2/2	2/2	3/3	3/2	3/?	1	1	1	1	1	1
San Juan Mountains	2	1/1	2/2	1/0	1/1	1/?	0	0	0	0	0	0
TOTALS	39	22/17	23/15	22/15	24/16	24/?	5	7	4	5	5	2

Number of populations: Number of toad populations, based on the definition of "population" in the Boreal Toad Conservation Plan.

Populations w/Breeding/Recruitment: Populations where any type of breeding activity was documented and/or recruitment of toadlets from that year was observed in the following year: # Before / = Breeding; # After / = Recruitment. NOTE: Recruitment from 2005 production can not be determined until 2006 surveys are done.

Populations w/ 20+ Breeders & 4+ Egg masses: Indicates number of populations where 20 or more breeding adults were observed and 4 or more viable egg masses were produced.

"Viable" Populations: Represents the number of populations in the historic area of occurrence which meet the criteria for "viable populations" as presented in the Boreal Toad Conservation Plan, and can be counted towards delisting goals.

Park Range

This area extends from south-central Carbon County, WY, through western Jackson County and eastern Routt County, CO, along the Continental Divide to approximately Rabbit Ears Pass. It is located primarily within the Routt and Medicine Bow National Forests.

There are presently five known boreal toad breeding localities in this area. The Soda Creek population has only one known breeding locality, and the North Fork of the Elk River population has two localities as of 2002. In 2001, a breeding locality in Jackson County (deemed the Red Canyon population) was discovered. In 2005, the Muddy Pass Lake breeding locality was discovered in Jackson County.

ROUTT COUNTY

Locality RO02 - Soda Creek (Soda Creek)				Bd Status: Not sampled
Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
1996	1/1/1	Unk	3 (M,2,A)	Nine metamorphs seen
1997	1/1/1	Yes	2 (M,A)	Numerous metamorphs
1998	0/0/0	No	1(1)	Inadequate monitoring
1999	1/1/0	Yes	1(A)	One female toad seen.
2000	0/0/0	Unk	1(1)	One yearling toad seen
2001	0/0/0	Unk	None seen	Inadequate monitoring
2002	0/0/0	Unk	None seen	Inadequate monitoring
2003	0/0/0	Unk	None seen	Site visited 3 times
2004	0/0/0	Unk	None seen	Site visited once*
2005	0/0/0	Unk	None seen	Site visited once

* Stream net surveys were done in the area

Locality RO03 - Diamond Park (N. Fork of Elk River)				Bd Status: Not sampled
Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
1996	1/1/1	Yes	2 (M,A)	20 metamorphs seen
1997	1/1/1	Yes	3 (M,1,A)	Few metamorphs seen
1998	0/1/0	No	1 (1,A)	Inadequate monitoring
1999	0/2/0	No	1(A)	Only two toads seen
2000	0/0/0	Unk	None seen	Site visited three times
2001	0/0/0	Unk	None seen	Inadequate monitoring
2002	0/0/0	Unk	None seen	One site visit
2003	0/0/0	Unk	None seen	Site visited twice
2004				Site not monitored
2005				Site not monitored

Locality RO06 - Upper Buck Mountain (N. Fork of Elk River)				Bd Status: Positive (2004)
Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
2000	9/4/4	Yes	3 (M,S,A)	Est. <50 metamorphs
2001	6/2/2	Yes	4(M,1,S,A)	Est.100-500 metamorphs
2002	5/2/2	Yes	3(1,S,A)	Metamorphs not observed
2003	6/6/6	Yes	3(M,1,A)	Est. 50-100Metamorphs
2004	2/1/1	Yes	4(M,1,S,A)	500-1000 Metamorphs
2005	11/15/6	Unk	3(1,S,A)	Likely many metamorphs

JACKSON COUNTY

Locality JA01 – Spike Lake (Red Canyon)				Bd Status: Not tested
Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
2001	1/1/1	Unk	1(M)	Two visits after discovery
2002	1/1/1?	Unk	?	Site info not provided*
2003	0/0/0	Unk	none seen	
2004				Not monitored
2005	2/2/2	Unk	1(A)	Access difficult

This breeding locality was discovered in 2001; tadpoles and metamorphs, but no adult toads, were observed.

*Tadpoles taken from this site to NASRF in 2002, but monitoring information not submitted.

Locality JA03 – Muddy Pass Lake (Muddy Pass)				Bd Status: Positive (2005)
Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
2005	2/2/2	Unk	2(M,A)	Site discovered 6/20/05

* * *

Elkhead Mountains

This mountain area is in western Routt County and eastern Moffat County, CO, northeast of Craig. It is located primarily within the Routt National Forest. The only known boreal toad breeding population in this area is in California Park. There are two known breeding localities at this time (First Creek and Torso Creek). Although evidence of reproduction has been observed in several locations, a specific breeding site was not found until 2000 near Torso Creek.

ROUTT COUNTY

Locality RO01 - First Creek (California Park)				Bd Status: Not tested
Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
1995	0/0/0	Yes	2(2,3)	Numerous sub-adults
1996	1/1/1	Unk	2(S,A)	Larvae seen
1997	1/0/0	Unk	2(S,A)	Toads along Elkhead Cr.
1998	0/0/0	No	1(S)	Inadequate Monitoring
1999	0/0/0	No	None seen	Monitoring adequate
2000	0/0/0	No	None seen	Monitoring adequate
2001	0/0/0	No	None seen	Monitoring inadequate
2002				Not monitored
2003	0/0/0	Unk	None seen	Site visited once
2004				Not monitored
2005				Not monitored

Locality RO04 - Torso Creek (California Park)				Bd Status: Positive (2004)
Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
1999	0/1/0	Unk	3(1,S,A)	Numerous 1 year olds
2000	2/2/2	Unk	3(M,2,A)	Approx. 400 metamorphs
2001	2/1/1	Yes	4(M,1,S,A)	>50 metamorphs
2002	1/1/1	Yes	3(1,S,A)	Site dried by August visit
2003	3/2/1	Yes	2(M,A)	<50 metamorphs
2004	1/1/1	Unk	4(M,1,S,A)	1000+ metamorphs
2005	1/1/1	Unk	3(M,S,A)	Numerous sub-adults

An enclosure was constructed around the breeding area to exclude sheep.

* * *

Medicine Bow Range

This is an area extending from southeastern Carbon County and western Albany County, WY, south through eastern Jackson County and western Larimer County, CO, to approx. Cameron Pass. It is situated primarily within the Routt and Roosevelt National Forests and on the Colorado State Forest.

At this time, there is only one known breeding site, Bird Creek, located in Albany County, Wyoming. Based on historic and recent observations of toads in Carbon and Albany counties, it is likely that other breeding populations will be found in the Medicine Bow Range, given adequate survey effort. A confirmed sighting of an adult boreal toad was made in the upper Laramie River drainage, in Larimer County, CO in 1998, but surveys in 1999 and 2000 failed to find a breeding site or toads.

ALBANY COUNTY, WY

Locality WY01 - Bird Creek (Albany)				Bd Status: Not tested
Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
1993	1/1/1	Yes	1(A)?	No counts of adults/eggs
1994	4/1/1	Yes	3(1,S,A)	
1995	4/1/1	Yes	3(1,S,A)	
1996	2/1/1	Yes	4(M,1,S,A)	17 toadlets collected
1997	3/3/3	Yes	4(M,1,S,A)	Some eggs collected
1998	0/0/0	No	2(1,S)	No reproduction seen
1999	0/0/0	No	None seen	Surveys adequate
2000	0/3/0	No	1(A)	Three & toads seen*
2001	0/1/0	No	1(A)	One female toad seen*
2002	0/1/0	Unk	1(A)	One female toad seen*
2003	1/0/0	Unk	1(A)	One male toad seen
2004	0/0/0	Unk	None seen	
2005	0/0/0	Unk	None seen	

This site is the source for stock used for reintroductions at Lake Owen

*Two of the three female toads found in 2000 were placed in captivity at the Sybille Wildlife Research Station; the female toads seen in 2001 and 2002 were not taken into captivity.

* * *

Front Range

This is an extensive area in northern Colorado, which includes southwestern Larimer County, eastern and southern Grand County, the western portions of Boulder, Gilpin, and Clear Creek counties, and eastern Summit County. It extends from the Mummy Range, in the north, south through Rocky Mountain National Park, to Loveland Pass and the Mt. Evans Wilderness Area. Much of the area is situated within the Arapahoe/Roosevelt National Forest.

There are twenty-seven (27) known breeding localities, comprising sixteen (16) populations, within the Front Range area as of 2005. These breeding populations and localities are located in five counties, as follows:

LARIMER COUNTY

Locality LR01 - Lost Lake (North Fork, Big Thompson, RMNP) Bd Status: Positive (2000)

Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
1990	?/?/22	Unk	1(A)	Incomplete data
1991	206/28/15	Unk	1(A)	No data on sub-adults
1992	143/23/23	Unk	1(A)	No data on sub-adults
1993	77/10/?	Unk	1(A)	Incomplete data
1994	110/35/35	Unk	1(A)	No data on sub-adults
1995	122/32/32	Yes*	1(A)	No data on sub-adults
1996	43/15/15	No	1(A)	No data on sub-adults
1997	112/15/15+	No	3(M,2*,A)	15 to 20 egg masses
1998	106/12/12	Unk	2(M,A)	150+ Metamorphs seen
1999	10/10/10	Unk	1(A)	Metamorphs possible
2000	3/3/3	Unk	1(A)	Positive for chytrid
2001	0/3/0	Unk	1(A)	Only females observed
2002	0/1/0	Unk	1(A)	One female observed
2003	0/0/0	Unk	None seen	Surveys adequate
2004	0/0/0	Unk	None seen	Juvenile toads found
2005	3/3/3	Unk	1(A)	Larvae seen

* Recruitment in 1995 based on observation of 2 year old toads in 1997.

Locality LR02 - Kettle Tarn (North Fork, Big Thompson, RMNP) Bd Status: Positive (2001)

Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
1990	?/?/13	Unk	1(A)	Incomplete data
1991	21+/23/23	Unk	1(A)	No data on sub-adults
1992	63/18/18	Unk	1(A)	No data on sub-adults
1993	54/25/25	Unk	2(M,A)	
1994	120/21/21	Unk	2(M,A)	
1995	210/24/24	Unk	2(M,A)	
1996	29/13/8	Unk	3(M,2,A)	
1997	15/11/0	No	1(A)	
1998	18/13/10	Unk	1(A)	
1999	15/8/2	Yes*	1(A)	No metamorphs seen
2000	13/5/3	Unk	2(1,A)	One 1 year old seen*
2001	2/4/3	Yes	3(M,S,A)	Metamorphs observed*
2002	2/2/2	Yes	3(M,1,A)	See note**
2003	3/3/3	Yes	3(M,1,A)	500+ metamorphs
2004	2/2/2	Unk	3(1,S,A)	Site dry by end of July
2005	0/1/0	Unk	1(A)	Good water levels

* Metamorphs observed, but number not estimated in monitoring form.

** Tadpoles from NASRF released at site; it is unknown whether metamorphs observed in 2002 derived from naturally produced clutches or from these released tadpoles.

Locality LR03 - Spruce Lake (Big Thompson River, RMNP) Bd Status: Negative (2005)

Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
1996	Unk	Yes	Unk	Reproduction presumed
1997	3/1/?	Unk	3(1,S,A)	Limited monitoring
1998	9/3/1	Unk	1(A)	Inadequate monitoring
1999	9/3/1	Yes	2(S,A)	Inadequate monitoring
2000	10/4/2	Unk	3(M,1,A)	Three 1 year olds seen
2001	10/2/2	Unk	2(S,A)	Larvae observed*
2002	15/3/3	Unk	1(A)	No metamorphs observed
2003	12/1/1	Unk	1(A)	No larvae observed
2004	10/2/2	Unk	1(A)	No larvae observed
2005	7/5/5	Unk	1(A)	Larvae observed

*Last site visit June 20, prior to time of metamorphosis.

Locality LR04 - Glacier Basin (Big Thompson River, RMNP) Bd Status: Not tested

Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
1995	1/1/0	Unk	1(A)	
1996	1/1/1	Yes	1(A)	Transplant site
1997	0/1/0	No	2(1,A)	
1998	3/0/0	Unk	1(A)	No breeding activity seen
1999	3/0/0	Unk	1(A)	No night survey done
2000	0/0/0	Unk	None seen	Monitoring adequate
2001				Not monitored

This site will no longer be regularly monitored after 2000. Translocation appears unsuccessful (Muths et al. 2001).

Locality LR05 - Twin Lake (South Cache la Poudre) Bd Status: Positive (2001)

Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
1998	1/1/1	Unk	1(A)	Tadpoles observed
1999	0/0/0	Unk	None seen	Site disturbed*
2000	0/0/0	Yes	None seen	Low water
2001	3/2/2	Yes	3(1,S,A)	No metamorphs seen
2002	1/1/1	Unk	2(S,A)	No metamorphs seen
2003	0/0/0	Unk	0	Site disturbed
2004				Not monitored
2005				Not monitored

* In 1999, there was temporary disturbance at this site due to testing of reconstructed dam.

Locality LR06 – Trout Creek (Trout Creek) Bd Status: Not tested

Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
2004	2/2/2	Unk	1(A)	Site found 6/22/2004
2005	0/0/0	Unk	None seen	

Locality LR07 – Panhandle Creek (Panhandle Creek)				Bd Status: Not tested
Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
2004	3/2/0	Unk	2(S,A)	Exact site not found
2005	0/0/0	Unk	None seen	

Locality LR08 – Ypsilon Lake Area (Ypsilon Lake)				Bd Status: Negative (2005)
Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
2004	4/4/0	Yes	2(M,A)	
2005	2/2/2	Unk	2(1,A)	

BOULDER COUNTY

Locality BO01 - Lost Lake (Middle Boulder Creek)				Bd Status: Not tested*
Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
1996	0/1/0	No	2(M,A)	Toadlets introduced
1997	0/1/1	No	3(M,1,A)	Toadlets introduced**
1998	0/2/0	No	3(1,2,A)	No breeding observed
1999	0/0/0	No	None seen	Minimal surveys done
2000	0/0/0	No	None seen	Monitoring adequate
2001	0/0/0	No	None seen	Monitoring adequate
2002	0/0/0	Unk	None seen	Monitoring adequate
2003	0/0/0	Unk	None seen	Site visited 3 times
2004	0/0/0	Unk	None seen	Site visited 2 times
2005	0/0/0	Unk	None seen	Site visited 2 times

This is an experimental reintroduction site. Monitoring continued through 2002.

*PCR test results were chytrid negative for samples from 5 groups of sentinel tadpoles placed at Lost Lake in 2001.

**Tadpoles observed, possibly from mating of a resident female and a translocated male toad.

GRAND COUNTY

Locality GR01 - Jim Creek (Winter Park)				Bd Status: Not tested
Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
1995	5/1/?	Unk	3+(S,A)	Substantial population
1996	?/?/0	Unk	3+(S,A)	Substantial population
1997	0/0/0	Unk	None observed	Monitoring inadequate
1998	0/0/0	Unk	None observed	Monitoring inadequate
1999	0/0/0	Unk	None observed	No night survey done
2000	0/0/0	Unk	None observed	Monitoring adequate
2001	0/0/0	Unk	None observed	No night survey done
2002				Not monitored
2003	0/0/0	Unk	None observed	Site visited 7 times
2004	0/0/0	Unk	None observed	
2005				Not monitored

Population indicates breeding pre-1996, but no actual breeding site found.

Locality GR02 - Pole Creek (Pole Creek)				Bd Status: Positive(2002)
Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
1995	5/3/3	Unk	2(M,A)	Numerous metamorphs
1996	3/3/3	Yes	2(M,A)	Few metamorphs
1997	10/4/2	No	2(1,A)	Few, if any, metamorphs
1998	5/2/2	Yes*	2(M,A)	Monitoring marginal
1999	5/5/5	Unk	2(M,A)	Metamorphs at #4
2000	6/2/2	Yes	3(M,S,A)	One clutch desiccated
2001	9/7/7	Yes	4(M,1,S,A)	>500 metamorphs
2002	14/6/6	Yes	4(M,1,S,A)	Metamorphs present**
2003	7/2/2	Yes	4(M,1,S,A)	>500 metamorphs
2004	2/2/2	Yes	3(M,S,A)	>150 metamorphs
2005	34/8/8	Unk	4(M,1,S,A)	>3000 metamorphs

This locality is on Pole Creek Golf Course, near holes #4 and #15.

* Recruitment from 1998 production based on observation of sub-adult toads in 2000.

**Metamorphs sampled on 9/23/02 were chytrid-positive.

Locality GR03 - Vasquez Creek (Vasquez Creek)				Bd Status: Not tested
Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
1999	1/1/1	Yes*	1(A)	Found late in season
2000	0/0/0	Unk	None seen	Monitoring adequate
2001	0/0/0	Unk	1(S)	One sub-adult seen*
2002	0/0/0	Unk	None seen	One site visit
2003				Site not monitored
2004	0/0/0	Unk	None seen	
2005	0/0/0	Unk	1(A)	1 adult seen

* 16 toadlets from 1999 clutch were captive reared and released in Vasquez Creek drainage in 2000; the sub-adult observed in 2001 was observed at the release site. No toads were observed at the 1999 breeding site.

Locality GR04 – McQueary Lake (Upper Williams Fork)				Bd Status: Positive (2003)
Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
2001	2/3/3	Yes	2(1,A)	No metamorphs observed
2002	8/6/6	Unk	2(M,A)	<50 metamorphs seen
2003	2/2/2	Unk	2(S,A)	Desiccation & predation
2004	0/0/0	Unk	None seen	
2005	0/0/0	Unk	None seen	

Locality GR05 – Upper Williams Fork (Upper Williams Fork)				Bd Status: Negative (2003)
Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
2001	2/2/2	Yes	3(M,1,A)	Metamorphs observed
2002	1/1/1	Yes	3(1,S,A)	No metamorphs seen
2003	1/2/1	Yes	4(M,1,S,A)	<50 metamorphs
2004	2/2/2	Yes	4(M,1,S,A)	Cold water temps
2005	2/1/1	Unk	2(1,S,A)	Metamorphs possible

Locality GR06 – Big Meadow (Big Meadow)				Bd Status: Positive (2004)
Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
2004	1/1/0	Yes	3(M, 1,A)	
2005	2/2/2	Unk	2(1,A)	

SUMMIT COUNTY

Locality SU02 - Montezuma (Snake River)				Bd Status: Not tested
Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
1995	7/1/1	No	2(S,A)	Breeding unsuccessful
1996	9/?/0	No	1(A)	No breeding observed.
1997	1/1/1	Unk	1(A)	New site, vs. '95 & '96
1998	0/0/0	Unk	None seen	Monitoring inadequate
1999	3/1/1	Unk	1(A)	Tadpoles observed
2000	0/0/0	Unk	None seen	No access to property*
2001				Not monitored
2002	0/0/0	Unk	None seen	2 site visits
2003				Not monitored
2004				Not monitored
2005				Not monitored

*This site is on private property, and permission for ongoing access needs to be obtained.

Locality SU03 - Peru Creek (Snake River)				Bd Status: Positive (2001)
Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
1996	1/1/1	Yes	3(M,S,A)	May be > 3 age classes
1997	6/2/2	Unk	4(M,1,S,A)	Good metamorphosis
1998	3/1/1	Unk	2(M,A)	Monitoring inadequate
1999	14/1/1	Unk	1(A)	Monitoring minimal
2000	19/1/1	Yes	1(A)	Tadpoles seen
2001	29/1/1	Unk	2(1,A)	Inadequate monitoring
2002	2/1/1	Unk	2(M,A)	>500 metamorphs
2003				Not monitored
2004	0/0/0	Unk	None seen	Low water levels
2005	0/0/0	Unk	None seen	Low water levels

Disturbance from construction was observed in the wetland area, but not the breeding pond itself, on 6/15/01. Monitoring in 2001 did not occur around the time that metamorphosis would be expected.

Locality SU06 - Upper North Fork of Snake River (Snake River)				Bd Status: Positive (2001)
Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
1998	1/2/1	Unk	3(M,S,A)	1st survey mid-July
1999	1/1/1	Unk	2(S,A)	Some tadpoles seen
2000	1/1/1	Unk	2(M,A)	10-20 metamorphs seen
2001	1/1/1	Yes	2(1,A)	Inadequate monitoring
2002	1/2/1	Unk	2(1,A)	Inadequate monitoring
2003				Not monitored
2004	16/0/0	Unk	1(A)	Site visited 3 times
2005	20/0/0	Unk	1(A)	

One male, one female, and 13 additional toads observed 5/24/01; About 100 tadpoles and 23 yearlings observed 7/20/01. Bd testing in 2004 was negative.

Locality SU07 - Lower North Fork of Snake River (Snake River)				Bd Status: Negative (2004)
Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
1998	1/2/1	Unk	3(M,S,A)	1st survey mid-July
1999	1/2/0	Unk	1(A)	No breeding observed
2000	1/1/0	Unk	1(A)	No breeding observed
2001	1/0/0	Unk	1(A)	Inadequate monitoring
2002	0/0/0	Unk	None seen	Three site visits
2003				Not monitored
2004	1/0/0	Unk	1(A)	Site visited 3 times
2005	0/0/0	Unk	None seen	

Locality SU08 – Straight Creek (Snake River)				Bd Status: Negative (2003)
Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
2003	1/1/1	Unk	3(M,S,A)	Site discovered 5/29/03
2004	0/0/0	Unk	None seen	Site visited 3 times
2005	0/0/0	Unk	None seen	

CLEAR CREEK COUNTY

Locality CC01 - Vintage (Clear Creek West Fork)				Bd Status: Not tested
Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
1994	?/?/?	Unk	Multiple	Little data available
1995	3/2/2	Unk	2(M,A)	Prob. few metamorphs
1996	1/1/1	No	1(A)	No production
1997	1/1/1	No	1(A)	Eggs froze
1998	3/0/0	No	1(A)	No breeding observed
1999	3/0/0	No	1(A)	No breeding observed
2000	0/0/0	No	None seen	Minimal monitoring
2001	0/0/0	Unk	None seen	Minimal monitoring
2002				Not monitored
2003	0/0/0	Unk	None seen	No evidence of breeding
2004				Not monitored
2005	0/0/0	Unk	None seen	No evidence of breeding

*All site visits in 2001, including night surveys, conducted in May.

Locality CC02 - Urad/Henderson (Clear Creek West Fork) Bd Status: Positive (2004)

Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
1995	131/19/19	Yes	4(M,1,S,A)	
1996	142/18/18	Yes	4(M,1,S,A)	Few metamorphs
1997	167/33/23	Yes	4+(M,1,S,A)	
1998	203/107/55	Yes	4(M,1,S,A)	Many metamorphs
1999	141/60/60	Unk	4(M,1,S,A)	Bd mortality
2000	34/34/34	Yes	2(M,A)	
2001	14/14/14	Unk	3(M,1,A)	Some egg mortality*
2002	25/22/22	Unk	2(M,A)	Several sites dry**
2003	15/15/15	Yes	1(A)	
2004	10/16/16	Unk	3(M,1,A)	Several sites dried up
2005	2/12/12	Unk	2(M,A)	Poor hatching success

*Egg mass mortality due to a water fungus observed at the Hesbo site; other sites had good egg mass survival.

Locality CC03 - Herman Gulch (Clear Creek) Bd Status: Positive (2004)

Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
1993	?/?/?	Unk	2(M,A)	Breeding observed
1994	11/11/11	Unk	2(M,A)	
1995	52/12/12	Unk	3(M,S,A)	Good production
1996	20/12/12	No	1(A)	Poor larvae survival
1997	19/10/10	Unk	3(M,S,A)	Many metamorphs
1998	10/10/10	Unk	2(M,A)	Few metamorphs seen
1999	11/11/11	Yes	1(A)	High egg mortality
2000	9/5/5	Unk	3(1,S,A)	No metamorphs seen
2001	2/2/4	Unk	3(M,S,A)	<50 metamorphs
2002	0/1/0	Unk	1(A)	No evidence of breeding
2003	1/1/1	Yes	1(M)	<50 metamorphs
2004	4/4/4	Unk	2(1,A)	
2005	0/0/0	Unk	None seen	

Locality CC04 - Mount Bethel (Clear Creek)

Bd Status: Positive (2005)

Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
1993	Yes	Unk	2(M,A)	Many metamorphs
1994	Yes	Unk	2(M,A)	
1995	4/1/1	No	2(S,A)	Few, if any, metamorphs
1996	3/3/3	Unk	2(M,A)	Few metamorphs
1997	9/1/1	Unk	2(M,A)	
1998	11/3/3	Unk	2(M,A)	36+ metamorphs seen
1999	23/1/1	Yes	2(M,A)	500+ metamorphs seen
2000	29/3/3	Yes	4(M,1,S,A)	Many metamorphs seen
2001	28/6/5	Yes	4(M,1,S,A)	500+ metamorphs seen
2002	16/4/4	Yes	3(M,1,A)	Metamorphosis early
2003	7/7/7	Unk	3(M,1,A)	<50 metamorphs
2004	68/8/8	Unk	3(M,S,A)	<50 metamorphs
2005	33/6/6	Unk	2(M,A)	Tested Bd positive

Locality CC05 - Bakerville (Clear Creek)

Bd Status: Not tested

Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
1994	1/1/1	Unk	2(M,A)	Limited data
1995	Unk	Unk	Unk	Site not monitored
1996	0/0/0	No	None seen	
1997	Unk	Unk	Unk	Site not monitored
1998	0/0/0	Unk	None seen	Inadequate monitoring
1999	0/1/0	Unk	1(A)	Inadequate monitoring
2000	0/0/0	Unk	None seen	Monitoring adequate
2001	3/0/0	Unk	1(A)	Inadequate monitoring
2002				Site not monitored
2003	1/1/1	Unk	1(A)	Few tadpoles found
2004	0/0/0	Unk	None seen	
2005	0/0/0	Unk	None seen	

Locality CC06 - Silverdale (Clear Creek South) Bd Status: Negative (2003)

Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
1993	?/?/0	Unk	Multiple	First survey of site
1994	?/?/0	Unk	Multiple	No metamorphs
1995	2/0/0	Unk	2(S,A)	No breeding observed
1996	5/0/0	No	1(A)	No breeding observed
1997	0/0/0	No	None seen	Inadequate monitoring
1998	1/1/0	Unk	2(S,A)	Monitoring marginal
1999	0/0/0	Yes	1(S)	41 sub-adults seen
2000	0/0/0	Unk	2(1,S)	Many sub-adults seen
2001	0/0/0	Unk	2(S,A)	65 sub-adults, 7 adults*
2002				Site not monitored
2003				Site not monitored
2004	0/0/0	Unk	None seen	
2005	0/0/0	Unk	1(A)	9 un-sexed adults seen

* Breeding site used in 1990s apparently not being used at present, and location of current breeding site unknown.

Locality CC07 - Otter Mountain (Clear Creek South) Bd Status: Negative (2003)

Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
2003	1/1/1	Unk		200 tadpoles seen
2004	2/2/2	Unk	1(A)	50 tadpoles seen
2005	0/0/0	Unk	1(A)	1 adult seen

Gore Range

This is a geographic area extending from west-central Routt County and northwestern Grand County south to western Summit County, including the Eagle's Nest Wilderness Area. Much of this area is located within the White River and Arapahoe National Forests. Prior to 1999, there were only two known breeding localities in the Gore Range, both in east-central Summit County, and each with two or more breeding sites. Surveys in 1999 located two new breeding populations in the Gore Range. One is at east Vail, in Eagle County, and the other on the North Fork of Morrison Creek, in southeastern Routt County.

ROUTT COUNTY

Locality RO05 - North Fork Morrison Creek (Morrison Creek)				Bd Status: Negative (2005)
Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
1999	10/2/2	Yes	4(M,1,S,A)	Site found late July.
2000	7/3/3	Yes	4(M,1,S,A)	<50 metamorphs seen.
2001	29/10/1	Unk	4(M,1,S,A)	Three site visits
2002	15/1/1	Unk	2(S,A)	Three site visits
2003	13/1/0	Unk	1(A)	Two site visits
2004	12/1/0	Yes	1(A)	Two site visits
2005	19/5/0	Unk	3(M,1,A)	Three site visits

EAGLE COUNTY

Locality EA03 - East Vail (Vail)				Bd Status: Positive (2005)
Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
1999	3/1/1	Yes	3(M,S,A)	Site found late July.
2000	8/2/1	Unk	3(M,1,A)	Many metamorphs.
2001	32/4/3	Yes	3(M,S,A)	15 metamorphs seen
2002	7/1/1	Yes	4(M,1,S,A)	Many sub-adults
2003	4/1/1	Yes	4(M,1,S,A)	50-100 metamorphs seen
2004	5/1/1	Yes	4(M,1,S,A)	300+ metamorphs seen
2005	8/2/2	Unk	4(M,1,S,A)	500+ metamorphs seen

This site is near a bike path and surrounded by development.

SUMMIT COUNTY

Locality SU04 - Upper North Tenmile (North Tenmile Creek)				Bd Status: Negative (2005)
Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
1995	6/6/6	Unk	2(S,A)	Few, if any, metamorphs
1996	17/6/6	Unk	3(M,S,A)	Good production
1997	13/3/3	Unk	2(M,A)	Limited metamorphosis
1998	18/3/1	Yes	2(S,A)	Inadequate monitoring
1999	2/3/3	Unk	4(M,1,S,A)	Inadequate monitoring
2000	7/4/4	Unk	2(S,A)	Metamorphs likely
2001	8/2/2	Yes	1(A)	Larvae disappeared
2002	8/8/8	Yes	4(M,1,S,A)	No night survey
2003	1/1/1	Unk	1(A)	No larvae/metamorphosis
2004	5/1/1	Yes	2(S,A)	Late egg deposition
2005	2/2/2	Unk	2(1,A)	Poor hatching success

Locality SU05 - Lower North Tenmile (North Tenmile Creek)				Bd Status: Negative (2005)
Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
1996	4/2/2	Yes	2(M,A)	Few metamorphs
1997	1/2/1	Unk	2(1,A)	Little or no reproduction
1998	5/5/5	Unk	3(M,S,A)	Inadequate monitoring
1999	3/2/1	Unk	1(A)	Inadequate monitoring
2000	5/3/2	Unk	2(M,A)	Monitoring adequate
2001	3/4/3	Yes	2(M,A)	100 metamorphs seen
2002	2/2/2	Yes	3(M,1,A)	No night survey
2003	2/2/2	Unk	2(1,A)	Likely many metamorphs
2004	1/1/1	Yes	1(A)	Likely many metamorphs
2005	4/4/4	Unk	3(M,1,A)	Likely many metamorphs

Mosquito and Ten-Mile Range

This is an area extending from southern Summit County south to the Buffalo Peaks Wilderness Area in western Park County and northeast Chaffee County. Much of it is situated within the Arapahoe and Pike/San Isabel National Forests. As of 2005 there are three known boreal toad breeding localities in this geographic area, as follows:

SUMMIT COUNTY

Locality SU01 - Cucumber Gulch (Breckenridge)				Bd Status: Not tested
Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
1995	1/1/1	No	3+(M,S,A)	Mult. age classes seen
1996	?/?/0	No	2(S,A)	No breeding observed
1997	2/1/1	No	1(A)	Recruitment doubtful
1998	1/0/0	Unk	1(A)	Monitoring minimal
1999	1/1/1	Unk	1(A)	No metamorphs seen
2000	0/1/0	Unk	1(A)	Monitoring adequate
2001	0/0/0	Unk	None seen	Monitoring adequate
2002	0/0/0	Unk	None seen	5 site visits by CNHP
2003	0/0/0	Unk	None seen	4 site visits
2004	0/0/0	Unk	None seen	1 site visit, access issues
2005	1/1/0	Unk	1(A)	

CHAFFEE COUNTY

Locality CF07 - Fourmile Creek (Buffalo Peaks)				Bd Status: Negative (2005)
Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
1995	3/1/0	No	1(A)	No breeding observed
1996	2/2/2	Yes	2(M,A)	Numerous metamorphs
1997	3/3/3	Yes	4(M,1,2,A)	Good production
1998	1/1/1	Unk	4(M,1,S,A)	Late egg clutch
1999	6/3/2	Unk	2(S,A)	Eggs lost to desiccation
2000	1/0/0	Unk	1(A)	Monitoring adequate
2001	10/4/4	Yes	2(M,A)	Ca. 100 metamorphs
2002	1/2/1	Unk	2(1,A)	Tadpoles disappeared
2003	10/3/3	Unk	3(M,S,A)	Likely many metamorphs
2004	5/1/1	Yes	1(A)	Likely metamorphs
2005	9/5/5	Unk	3(M,1,A)	1000+ metamorphs

PARK COUNTY

Locality PA01 – Rough and Tumbling Creek (Buffalo Peaks)				Bd Status: Negative (2004)
Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
2004	2/2/2	Unk	1(A)	Site discovered 7/28/04
2005	2/2/2	Unk	1(A)	Likely many metamorphs

Sawatch Range

This geographic area includes western Lake and Chaffee counties and eastern Pitkin and Gunnison counties, and extends from the Holy Cross Wilderness Area south to Monarch Pass. It includes the upper Fryingpan drainage and eastern Taylor Park, and is situated primarily within the White River, San Isabel and Gunnison national forests.

There are nineteen (19) known breeding localities within this area. Fourteen (14) of these are located in the Collegiate Peaks area of Chaffee County, three (3) in southern Eagle County, one (1) in eastern Pitkin County, and one (1) in eastern Gunnison County. The twelve sites in the Cottonwood Creek drainage of Chaffee County comprise the most substantial remaining metapopulation of boreal toads in the Southern Rocky Mountains.

CHAFFEE COUNTY

Locality CF01 - Collegiate Peaks Campground (Cottonwood Creek) Bd Status: Negative (2005)

Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
1993	1/1/1	Yes	1(A)	Reproduction presumed
1994	1/1/1	Unk	4(1,2,3,A)	Larvae observed
1995	11/5/5	Unk	3+(M,S,A)	Sub-adults not aged
1996	13/5/5	Unk	3(M,S,A)	Few metamorphs
1997	10/8/6	Unk	2(M,A)	Numerous metamorphs
1998	38/7/7	Yes	2(M,A)	1st year of PIT tagging
1999	24/3/3	Yes	4(M,1,S,A)	4 one-year olds seen
2000	6/6/3	Unk	3(M,1,A)	1 one-year old seen
2001	12/6/6	Yes	3(M,S,A)	Numerous metamorphs
2002	21/4/3	Yes	4(M,1,S,A)	About 200 metamorphs
2003	23/5/5	Yes	4(M,1,S,A)	~3000 eggs removed
2004	18/9/9	Yes	4(M,1,S,A)	~7000 eggs removed
2005	41/5/5	Unk	3(1,S,A)	4 egg masses desiccated

Locality CF02 - Denny Creek (Cottonwood Creek) Bd Status: Negative (2005)

Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
1994	5/5/5	Unk	2(S,A)	Probably metamorphs
1995	16/10/3	Unk	3(M,S,A)	Sub-adults not aged
1996	4/4/4	Yes	3(M,S,A)	Metamorphs present
1997	10/4/4	Yes	3(1,2,A)	Few, if any, metamorphs
1998	55/22/22	Yes	4(M,1,S,A)	1st year of PIT tagging
1999	63/18/16	Yes	4(M,1,S,A)	Good production
2000	58/23/23	Yes	4(M,1,S,A)	Good production
2001	52/22/22	Yes	4(M,1,S,A)	Numerous metamorphs
2002	27/13/13	Unk	4(M,1,S,A)	Only 1 metamorph seen
2003	33/22/14	Yes	3(M,S,A)	Slow to develop
2004	21/12/12	Yes	3(M,S,A)	~8000 eggs removed
2005	41/19/14	Unk	4(M,1,S,A)	~4000 eggs removed

Locality CF03 - Hartenstein Lake (Cottonwood Creek)

Bd Status: Negative (2005)

Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
1994	5/?/?	Unk	1(A)	Limited data
1995	29/6/6	Unk	1(M,A)	Few metamorphs seen
1996	10/2/2	Yes	2(M,A)	Metamorphs presumed
1997	12/5/5	Unk	2(M,1,A)	Many metamorphs
1998	31/7/5	Yes	3+(M,S,A)	1st year of PIT tagging
1999	64/10/9	Unk	2(1,A)	Predation by mallards
2000	57/14/14	Yes	2(M,A)	Few metamorphs
2001	69/5/5	Yes	3(1,S,A)	Four yearlings seen
2002	21/4/4	Yes	4(M,1,S,A)	Metamorphosis early
2003	11/7/7	Yes	2(S,A)	No metamorphs seen
2004	24/3/3	Unk	3(1,S,A)	Metamorphs presumed
2005	24/7/7	Unk	3(M,S,A)	Poor hatching

Locality CF04 - South Cottonwood Creek (Cottonwood Creek)

Bd Status: Negative (2005)

Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
1995	24/3/3	Unk	3(M,S,A)	Numerous metamorphs
1996	12/4/4	Yes	2(M,A)	Good production
1997	26/3/3	Yes	4(M,1,2,A)	Numerous metamorphs
1998	35/7/7	Yes	4(M,1,S,A)	1st year of PIT tagging
1999	45/11/11	Yes	3(M,1,A)	Numerous metamorphs
2000	54/10/10	Yes	4(M,1,S,A)	Numerous metamorphs
2001	51/5/5	Yes	4(M,1,S,A)	Numerous metamorphs
2002	26/5/5	Yes	4(M,1,S,A)	Low water levels*
2003	62/4/4	Unk	4(M,1,S,A)	>500 metamorphs
2004	35/3/3	Yes	1(A)	Metamorphs presumed
2005	79/5/4	Unk	3(M,1,A)	

*In 2002, in addition to adults caught and gender determined, approximately 15 additional adults seen but not captured; few metamorphs observed.

Locality CF05 - Brown's Creek (Brown's Creek) Bd Status: Negative (2005)

Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
1995	2/3/1	Yes	2(S,A)	Metamorphs unlikely
1996	4/4/4	Unk	3(M,S,A)	Few metamorphs
1997	2/2/2	Unk	3(M,2,A)	Fair metamorphosis
1998	0/1/0	Unk	1(A)	No breeding observed
1999	3/2/2	Unk	2(M,A)	Snake predation
2000	0/0/0	Unk	None seen	Monitoring adequate
2001	1/2/1	Unk	2(M,A)	5 metamorphs seen
2002	2/3/1	Unk	1(A)	Tadpoles disappeared
2003	1/1/0	Unk	1(A)	No evidence of breeding
2004	0/0/0	Unk	None seen	No evidence of breeding
2005	1/1/1	Unk	1(A)	Possible predation loss

Locality CF06 - Kroenke Lake (Cottonwood Creek) Bd Status: Negative (2005)

Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
1995	3/2/2	Unk	1(A)	Metamorphs unlikely
1996	2/2/2	Unk	2(M,A)	Fair metamorphosis
1997	9/2/2	Unk	1(A)	Metamorphs unlikely
1998	3/3/3	Unk	1(A)	Metamorphs unlikely
1999	6/3/3	Unk	1(A)	No night surveys
2000	3/2/2	Unk	2(S,A)	One sub-adult seen
2001	9/1/1	Unk	3(M,S,A)	4 metamorphs
2002	2/2/2	Yes	2(M,A)	15 metamorphs seen
2003	16/3/3	Unk	3(M,1,A)	Likely many metamorphs
2004	2/2/2	Unk	2(M,A)	
2005	5/3/3	Unk	2(M,A)	Likely many metamorphs

Locality CF08 - Morgan's Gulch (Cottonwood Creek) Bd Status: Negative (2005)

Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
1997	19/6/6	Yes	2(M,A)	Many metamorphs
1998	24/1/1	Yes	4(M,1,S,A)	Eggs late season
1999	40/3/3	Unk	4(M,1,S,A)	One egg mass not viable
2000	17/5/5	Unk	2(S,A)	Few or no metamorphs
2001	12/5/5	Yes	3(M,S,A)	30 metamorphs seen
2002	10/0/0	Yes	2(S,A)	No breeding observed*
2003	21/7/7	Yes	2(S,A)	Likely desiccation loss
2004	7/2/2	Unk	1(A)	Likely desiccation loss
2005	36/1/1	Unk	2(S,A)	Likely desiccation loss

*Pond dried by mid-June in 2002.

Locality CF09 - Sayre's Gulch (South Fork Lake Creek) Bd Status: Negative (2005)

Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
1997	9/1/1	Unk	1(A)	Site found late in season
1998	34/2/2	Unk	2(S,A)	Metamorphs few, if any
1999	4/4/2	Unk	2(S,A)	Larvae lost to mallards*
2000	8/5/5	Unk	2(S,A)	No early-season survey*
2001	13/5/5	Yes	2(S,A)	Larvae apparently lost**
2002	21/6/6	Yes	4(M,1,S,A)	
2003	9/4/4	Yes	4(M,1,S,A)	Likely many metamorphs
2004	13/6/6	Yes	2(1,A)	Likely desiccation loss
2005	23/5/5	Unk	4(M,1,S,A)	Late breeding

* Most larvae apparently lost to mallard and/or dytiscid predation in 1999 and 2000; the same may have occurred in 2001.

**Observation of 1 one year old toadlet in 2002 indicates at least some survival of tadpoles from 2001.

Locality CF10 - South Cottonwood Cr. West (Cottonwood Creek) Bd Status: Negative (2005)

Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
1998	2/2/2	Yes	2(M,A)	Excellent production
1999	9/9/9	Yes	3(M,1,A)	Good production
2000	19/9/9	Yes	3(M,1,A)	Good production
2001	26/7/7	Yes	4(M,1,S,A)	Numerous metamorphs
2002	14/5/5	Yes	4(M,1,S,A)	Numerous metamorphs
2003	6/6/6	Yes	4(M,1,S,A)	Numerous metamorphs
2004	9/5/5	Yes	3(M,1,A)	Numerous metamorphs
2005	5/5/5	Unk	4(M,1,S,A)	Very productive year

Locality CF11 - Rainbow Lake (Cottonwood Creek) Bd Status: Not tested

Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
1999	4/3/3	Unk	1(A)	Larvae lost to mallards
2000	1/1/1	Unk	2(S,A)	One sub-adult seen
2001	2/1/1	Yes	1(A)	Tadpoles disappeared*
2002	3/2/2	Unk	2(1,A)	Tadpoles disappeared
2003	1/1/1	Unk	1(A)	Few tadpoles found
2004	1/0/0	Unk	1(A)	No evidence of breeding
2005	0/0/0	Unk	None seen	No evidence of breeding

This site is on private land, and subject to considerable human use.

*Larvae may have been preyed on by mallards and gartersnakes, but at least one from 2001 survived as a one year old toadlet in 2002.

Locality CF12 - Middle Cottonwood (Cottonwood Creek) Bd Status: Negative (2005)

Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
1999	13/1/1	Unk	4(M,1,S,A)	8 one-year olds seen
2000	9/1/1	Unk	3(M,S,A)	Few metamorphs seen
2001	11/4/4	Yes	3(M,S,A)	100 metamorphs seen
2002	14/3/3	Yes	4(M,1,S,A)	15 metamorphs seen
2003	53/5/3	Yes	3(1,S,A)	Likely many metamorphs
2004	30/3/3	Yes	3(M,1,A)	~1000 eggs removed
2005	33/6/6	Unk	3(1,S,A)	Likely some metamorphs

Locality CF13 - Denny Creek West (Cottonwood Creek) Bd Status: Negative (2005)

Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
1999	5/2/2	Unk	1(M,1,A)	5 metamorphs seen
2000	1/0/0	Unk	1(A)	Minimal monitoring
2001	3/0/0	No	1(A)	Adequate monitoring
2002	3/3/3	Unk	3(1,S,A)	Metamorphosis possible*
2003	2/2/2	Yes	2(M,A)	Adequate monitoring
2004	2/3/1	Unk	2(1,A)	Likely desiccation loss
2005	3/1/1	Unk	2(M,A)	High water levels

*Five one year olds were observed in 2002 despite no breeding observed at this site in 2001; successful breeding in 2001 may have been overlooked or it is possible that the toadlets were from the Hartenstein or Denny Creek sites. No metamorphs were observed in 2002, but it is possible some were produced.

Locality CF14 - Denny Creek South (Cottonwood Creek) Bd Status: Negative (2003)

Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
1999	1/1/1	Unk	3(M,S,A)	4 sub-adults seen
2000	1/0/0	Unk	1(A)	Dried up mid-summer
2001	2/2/2	No	1(A)	Egg masses desiccated
2002	0/0/0	No	None seen	Site dry
2003	0/1/0	Unk	1(A)	Site dry
2004	0/0/0	Unk	None seen	Site dry most of season
2005	0/0/0	Unk	None seen	Site dry

Marginal site, subject to desiccation.

Locality CF15 – Holywater Beaver Ponds (Cottonwood Creek) Bd Status: Negative (2005)

Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
2002	3/3/3	Yes	1(M)	About 50 metamorphs
2003	5/1/1	Yes	2(1,A)	Some apparent egg loss
2004	1/0/0	Yes	3(1,S,A)	No evidence of breeding
2005	1/0/0	Unk	3(1,S,A)	No evidence of breeding

*Site discovered on July 3, 2002. No adults or sub-adults observed, and egg count estimated.

EAGLE COUNTY

Locality EA01 - Holy Cross City (Holy Cross City)				Bd Status: Negative (2003)
Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
1996	1/1/1	Unk	1(A)	Predation & late season
1997	1/1/1	Unk	1(A)	Recruitment unlikely
1998	2/2/2	Unk	1(A)	Inadequate monitoring
1999	2/0/0	Unk	1(A)	Inadequate monitoring
2000	1/0/0	Unk	1(A)	Inadequate monitoring
2001	1/1/1	Unk	None seen	5 visits to site*
2002	2/1/1	Unk	1(A)	Breeding pond dried**
2003	2/1/1	Unk	1(A)	5 visits to site
2004	1/0/0	Unk	1(A)	No evidence of breeding
2005	1/0/0	Unk	1(A)	No evidence of breeding

*Report of boreal toad tadpoles at this site in July 2001 by Bill Andree.

**In 2002, the breeding pond dried, probably before tadpoles could metamorphose.

Locality EA02 - East Lake Creek (East Lake Creek)				Bd Status: Negative (2005)
Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
1996	1/1/1	Unk	3(M,S,A)	Site found 8/13/96
1997	Unk	Yes	Unk	Site not monitored
1998	3/0/0	Yes	2(1,A)	Inadequate monitoring
1999	4/4/4	Yes	3(M,1,A)	No night survey done
2000	2/2/2	Unk	3(1,S,A)	Minimal monitoring
2001	1/0/0	Yes	1(A)	Only one adult male seen*
2002	2/2/2	Yes	3(1,S,A)	14 adults seen (not sexed)
2003	2/2/2	Yes	3(M,S,A)	Likely many metamorphs
2004	2/2/2	Yes	4(M,1,S,A)	
2005	16/1/1	Unk	4(M,1,S,A)	

Two closely associated breeding sites at this locality.

*Successful breeding in 2001 assumed due to 2 one year olds observed in 2002.

Locality EA04 – Strawberry Lakes (Holy Cross City)				Bd Status: Not tested
Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
2003	1/1/1	Unk	1(A)	100-500 tadpoles
2004	1/1/1	Unk	3(M,S,A)	100-500 tadpoles
2005	0/2/0	Unk	1(A)	Likely metamorphs

GUNNISON COUNTY

Locality GU03 - Magdalene Gulch (Texas Creek)				Bd Status: Negative (2005)
Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
1999	1/1/1	Unk	2(M,A)	Site found late in season
2000	2/1/0	Unk	1(A)	Adequate monitoring
2001	0/0/0	Unk	None seen	Inadequate monitoring
2002	0/0/0	Unk	None seen	One site visit
2003	0/0/0	Yes	None seen	Inadequate monitoring
2004	7/7/7	Yes	2(M,1)	Numerous metamorphs
2005	7/7/7	Unk	2(1,A)	Late snow at site

PITKIN COUNTY

Locality PI03 – Lincoln Creek (Lincoln Creek)				Bd Status: Not tested
Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
2005	0/0/0	Unk	1(M)	Site found 9/9/2005

* * *

White River Plateau

This geographic area includes southwestern Routt County, eastern Rio Blanco County, northeastern Garfield, and northwestern Eagle County. It includes the Flat Tops Wilderness and is situated primarily on the White River National Forest.

There are presently no known breeding sites in this area, although there have been reports of toad observations in recent years, primarily from the Trapper's Lake area. It is likely that one or more breeding sites may be located in this area, given adequate survey effort.

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Grand Mesa

This area incorporates western Gunnison County, northern Delta County, and eastern Mesa County, and is located primarily on the Grand Mesa and Gunnison national forests.

Historically, boreal toads were abundant on the Grand Mesa. Extensive surveys have been conducted on Grand Mesa, but despite this effort, no confirmed observations of boreal toads were made for approximately 25 years. In 2002, two field crews working in the Buzzard Creek drainage of Mesa County observed a total of three adult boreal toads. Photographs were taken of two of the toads, confirming the identification. In addition, tadpoles were observed along the same reach of stream as

two of the toads. However, the identification of the tadpoles as boreal toad tadpoles was not confirmed. Adult boreal toads were again seen in the Buzzard Creek drainage in 2003. Testing on these adults showed them to be chytrid positive. As of 2004, a breeding site has not been located in the Buzzard Creek drainage.

An experimental translocation of boreal toads to the Kannah Creek area in Mesa County was initiated in 2003. Over 35,000 tadpoles and 2,500 toadlets were released at the site over a three year period. This area lies approximately 24 miles southwest of recorded boreal toad sightings along Buzzard Creek, but movement between natural and translocated populations is precluded by several drainages. Testing of resident chorus frogs for *Batrachochytrium dendrobatidis* by PCR demonstrated that chytrid fungus is present at the site, yet over-winter survival of released toads has been documented.

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Elk and West Elk Mountains

This area consists of parts of western and northern Gunnison County west of Taylor Park, and southwest Pitkin County. It includes the Maroon Bells/Snowmass and West Elk wilderness areas.

Prior to 2000 there were three known boreal toad breeding sites in this area, one in southern Pitkin County, and the other two in northern Gunnison County. In 2000, new breeding sites were found on Brush Creek in Gunnison County, and on East Maroon Creek in Pitkin County. There have also been recent, reliable reports of toads from other localities within this area, such as Mt. Crested Butte, the Snowmass Lake area, near the town of Aspen, and in the Roaring Fork Drainage. With additional survey effort it is likely that more breeding populations will be located - especially in the Elk Mountains. However, no additional breeding localities were found during the 2003 field seasons. During the 2004 field season, a new breeding site was located on the Upper Taylor River. Based on 2003 Bd sampling results, the White Rock Mountain population meets viability criteria, to increase the number of viable populations to two.

PITKIN COUNTY

Locality PI01 - Conundrum Creek (Conundrum Creek)				Bd Status: Positive (2001)
Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
1995	3/1/1	Yes	2+(S,A)	Minimal monitoring
1996	1/1/1	Unk	2+(S,A)	Many metamorphs
1997	2/2/2	Unk	2(2,A)	Poor production
1998	2/2/0	Unk	1(A)	Inadequate monitoring
1999	0/0/0	Unk	Unk	Site not monitored
2000	2/2/2	Unk	2(M,A)	Adequate monitoring
2001	3/9/3	Yes	2(M,A)	100 metamorphs seen
2002	1/1/1	Unk	2(M,1)	Many metamorphs*
2003	0/0/0	Unk	None seen	
2004	0/0/0	Unk	None seen	
2005	0/0/0	Unk	None seen	One site visit

*No adults seen during many site visits, but at least one egg mass produced, resulting in hundreds of metamorphs.

Locality PI02 - East Maroon Creek (Conundrum Creek)				Bd Status: Negative (2005)
Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
2000	3/3/3	Yes	4(M,1,S,A)	Several ponds at site
2001	3/3/3	Yes	3(1,S,M)	Adults not observed
2002	3/3/3	Yes	4(1,M,S,A)	Breeding in 2 ponds
2003	3/3/3	Yes	3(M,S,A)	Numerous metamorphs
2004	7/1/1	Yes	3(1,S,A)	Possible metamorphs
2005	2/2/2	Unk	4(M,1,S,A)	Breeding in 2 ponds

In 2001, about 3 egg masses deposited although adults were not observed; 16 sub-adults and about 50 metamorphs seen.

GUNNISON COUNTY

Locality GU01 - Triangle Pass (White Rock Mountain) Bd Status: Negative (2005)

Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
1993	3/3/3	Unk	1(A)	Metamorphs unlikely
1994	Unk	Unk	Unk	No data
1995	1/1/1	Unk	2(S,A)	Metamorphs unlikely
1996	Unk	Yes	Unk	No monitoring
1997	2/2/2	Yes	4(M,1,S,A)	Many metamorphs
1998	17/5/5+	Unk	4(M,1,2,A)	Many metamorphs
1999	19/5/4	Unk	2(M,A)	No night survey done
2000	13/13/13	Unk	3(M,S,A)	One sub-adult seen
2001	18/14/11	Yes	2(M,A)	No night survey done
2002	16/17/16	Yes	3(1,S,A)	No visits after 7/25/02
2003	32/14/14	Unk	4(M,1,S,A)	Numerous metamorphs
2004	33/10/10	Unk	2(M,A)	Diving beetle predation
2005	8/1/1	Unk	1(A)	Locality snowed in

This locality has also been referred to as "White Rock Basin".

Locality GU02 - West Brush Creek (White Rock Mountain) Bd Status: Not tested

Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
1999	1/1/1	Unk	2(M,A)	<50 metamorphs seen
2000	0/0/0	Unk	None seen	Inadequate monitoring
2001	0/1/0	Unk	1(A)	Inadequate monitoring
2002	0/0/0	Unk	None seen	One site visit
2003	1/1/0	Unk	1(A)	One site visit
2004	0/0/0	Unk	None seen	
2005	0/0/0	Unk	None seen	

Locality GU04 - Brush Creek (White Rock Mountain) Bd Status: Negative (2005)

Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
2000	3/3/3	Yes	4(1,2,S,A)	Minimal monitoring
2001	6/1/1	Unk	3(1,S,A)	Minimal monitoring
2002	23/5/1	Yes	2(S,A)	Minimal monitoring
2003	7/2/1	Yes	1(A)	Minimal monitoring
2004	27/11/11	Unk	3(1,S,A)	Possible predation loss
2005	10/10/10	Unk	2(M,A)	New breeding pond found

Locality GU05 – Upper Taylor River (Upper Taylor River) Bd Status: Negative (2005)

Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
2004	2/0/0	Yes	4(M,1,S,A)	Site found post egg hatch
2005	1/1/1	Unk	3(1,S,A)	Significant snow at site

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San Juan Mountains

This is a large area in southern Colorado and northern New Mexico, which includes portions of Hinsdale, Archuleta, Mineral, Saguache, western Rio Grande, and Conejos counties in Colorado, and Rio Arriba County in New Mexico. It extends along the Continental Divide from Poncha Pass into northern New Mexico. Most of the boreal toad habitat in this area is located within the Gunnison, Rio Grande, San Juan, and Carson national forests.

Prior to 2000, there were only two known breeding sites in this area, and one of those two sites (Trout Creek) was questionable, as the tadpoles observed there in 1996 may have been the result of an unauthorized translocation from the Jumper Creek site, rather than natural breeding at that location. However, breeding at the West Trout Creek site (in Hinsdale County) supports the legitimacy of the Trout Creek observations.

There have been several good reports of observations of boreal toads from other localities in the San Juan Mountains, most notably from the Elk Creek drainage in Conejos County, Miner's Creek in Saguache County, and from near Chama, New Mexico. Survey efforts in these areas should continue.

MINERAL COUNTY

Locality MI01 - Jumper Creek (Trout Creek)				Bd Status: Negative (2003)
Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
1994	3/0/?	Unk	1(A)	1st toad observation
1995	Unk	Unk	Unk	Breeding likely
1996	4/2/1+	Yes	2(M,A)	Breeding observed
1997	8/3/3	Yes	3(M,1,A)	Many metamorphs
1998	7/1/2	Unk	4(M,1,S,A)	
1999	3/2/2	Unk	3(M,S,A)	<50 metamorphs seen
2000	4/2/2	Yes	1(A)	Site dessicated
2001	4/1/1	Yes	3(M,1,A)	<50 metamorphs seen
2002	0/0/0	Yes	1(1)	Site dry; 3 1-yr-olds seen
2003	1/1/1	Unk	2(1,A)	Possible desiccation loss
2004	1/1/1	Unk	1(A)	
2005	1/1/0	Unk	2(M,A)	Site filling w/vegetation

Locality MI02 - Trout Creek (Trout Creek)				Bd Status: Not tested
Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
1996	1/1/1(See note)	No	None seen	Tadpoles observed
1997	0/0/0	No	None seen	
1998	0/0/0	No	None seen	
1999	0/0/0	No	None seen	Only one site visit
2000	0/0/0	Unk	None seen	Minimal monitoring
2001	0/0/0	Unk	None seen	Minimal monitoring
2002	0/0/0	Unk	None seen	Minimal monitoring
2003	0/0/0	Unk	None seen	
2004				Not monitored
2005				Not monitored

NOTE: This site is questionable. 1996 observations may have been result of unauthorized transplant from Jumper Creek. No eggs, tadpoles, or toads have been observed during minimal monitoring efforts associated with site visits to West Trout Creek.

Locality MI03 – Roaring Fork Pond (Goose Creek)				Bd Status: Negative (2003)
Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
2000	1/1/1	Unk	2(M,A)	Site found late season
2001	3/0/0	Unk	1(A)	Minimal monitoring
2002	1/1/1	Yes	None seen	One egg mass; 2 visits
2003	3/0/0	Unk	1(A)	No evidence of breeding
2004	1/0/0	Unk	2(S,A)	No evidence of breeding
2005				Not monitored

Previously listed as Boots Pond; renamed here to conform to a CDOW database of pond names and NASRF records.

HINSDALE COUNTY

Locality HI01 - West Trout Creek (Trout Creek)				Bd Status: Negative (2003)
Year	M/F/Egg Masses	Recruitment	Age Classes	Comments
2000	2/2/2	Unk	2(M,A)	Site found mid-season
2001	4/4/4	Yes	4(M,1,S,A)	Minimal monitoring
2002	1/1/1	Yes	2(1,A)	1 visit, 6 1-yr-olds seen
2003	5/5/5	Yes	3(1,M,A)	100-200 metamorphs
2004	9/4/4	Yes	3(M,S,A)	Good reproduction
2005	0/0/0	Unk	3(M,1,S)	Excellent reproduction

* * *

BOREAL TOAD SURVEYS

In addition to annual monitoring of known breeding sites, surveys of historic and other suitable boreal toad habitats are conducted each year. The amount of survey work has been constrained by the availability of qualified personnel to conduct and supervise the work and by limited funding. Areas where surveys have concentrated over the past five years include Albany County (Wyoming), Rio Arriba County (New Mexico), Park Range, Front Range, Gore Range, Sawatch Mountains, Elk Mountains, and San Juan Mountains in Colorado. In 1999 a cooperative effort was initiated between the Colorado Division of Wildlife, Region 2 of the US Forest Service, and the Colorado Natural Heritage Program to conduct statewide surveys and a considerable portion of the breeding site monitoring work. Surveys since 1999 have resulted in the location of fifteen previously unknown breeding populations located and thirty-one new breeding localities.

In 2003, surveys for SRMP boreal toads in Wyoming resulted in observations at Bird Creek, Little Snake, North Fork Little Laramie, Ryan Park, Silver Run Lake, Sourdough Creek, and White Rock. Extensive surveys were also conducted in western Wyoming in 2003, yielding numerous toad and breeding site observations. Samples were collected for analysis to determine the relationships of these toads with those in the Southern Rocky Mountain population and to document Bd distribution in Wyoming.

In 2004, personnel from the Carson National Forest surveyed the Trout Lakes and Lagunitas areas of New Mexico. No boreal toads were observed.

In 2005, CNHP crews surveyed 108 sites in 7 Colorado counties, including Chaffee, Eagle, Gilpin, Grand, Jackson, Lake, and Pitkin. (Lambert 2006)

Data regarding areas surveyed, where no toads were found, is in the process of being gathered from various sources and compiled, and will be used to help plan future survey efforts. Ongoing survey efforts will continue, with a focus on locations from which reliable reports of boreal toad observations have been received in the past two years. Sampling of populations for presence/absence of Bd will continue.

PUBLIC INFORMATION & INVOLVEMENT

Ongoing efforts to involve the general public in the search for boreal toad populations include the distribution of picture post cards, which provide basic information about the toad, and directions on how, and where, to report toad observations. In addition, toad "wanted" posters continue to be distributed to inform the public, and personnel in various resource management agencies, about the boreal toad, and to provide information on how and where to report toad observations.

In the vicinity of known boreal toad breeding populations, information is posted at camp grounds, trailheads, and near breeding sites on National Forest lands to inform recreationists about the presence of the toads, in an effort to prevent inadvertent or intentional damage to the toads and their habitat.

Several news releases and public information videos have been produced to help inform the public about the boreal toad and about ongoing conservation efforts. These have been well received by most news media, and widely distributed. In addition, a 30-minute slide presentation on the boreal toad and its management was produced, and continues to be presented to various groups.

CAPTIVE PROPAGATION & TRANSLOCATIONS

Reintroduction and translocation of animals are tools which may be used in the recovery of threatened or endangered species. These actions may involve captive propagation and/or rearing. Preliminary work with experimental translocations and captive rearing of boreal toads has been done in the Southern Rocky Mountains. However, it has been decided by the Boreal Toad Recovery Team that this approach will be used only in cases where no other viable alternatives exist to re-establish boreal toads in areas where they are known to be extirpated, and for experimental/research purposes. The following are the guidelines, as established by the Boreal Toad Recovery Team in 1997, to determine if/when translocations/reintroductions should be done:

1. Boreal toads are determined to be extirpated from a historically occupied mountain range, based on thorough surveys*, and suitable habitat for toads still exists in that area.
(* Methodology outlined in the Boreal Toad Conservation Plan, 2001)
2. The chance of natural recolonization of the unoccupied area is minimal.
3. There is no known, significant and imminent environmental threat in the area which would preclude successful reintroduction and survival of boreal toads.
4. Available source stock of toads for transplants is sufficient to provide the numbers needed without doing harm to the source population(s).
5. There is a firm commitment from involved agencies to make the reintroduction effort a top priority for long-term funding, and to do long-term monitoring and evaluation. Ideally, such commitment should be stated in the form of a Cooperative Agreement or Memorandum of Understanding.

In light of the discovery of the presence of Bd in Colorado, and ongoing research, these guidelines were reviewed by the Boreal Toad Recovery Team with minor revisions.

Captive Propagation and Rearing

During the early 1990's, techniques and procedures for captive rearing and breeding of boreal toads were developed by the Wyoming Game & Fish Department and the Colorado Division of Wildlife. At the Sybille Wildlife Research Center, in Wyoming, boreal toads were reared in conjunction with efforts to raise captive Wyoming toads, and captive reared boreal toads were subsequently released at the Lake Owen site (see 'Experimental Translocations,' below). In Colorado, a small number of tadpoles were reared to toadlet stage at the University of Colorado in 1993 and 1994, for a subsequent experimental release in Boulder County (see page 45), and numerous toads were reared in captivity by the Colorado Division of Wildlife, at its Fish Research Hatchery in Bellvue, CO, from 1995 through 1997. The Division of Wildlife effort resulted in development of standard practices for rearing of boreal toads, and the "Hatchery Manual for the Rearing and Propagation of Captive Boreal Toads" was produced in March 1997. Captive propagation and rearing of toads in Colorado was discontinued in late 1997, with the intent of reinstating it only if it is needed for a future reintroduction.

After the discovery of Bd in Colorado, and the associated die-off of boreal toads in Clear Creek County in 1999, the Recovery Team decided it would be prudent to establish disease-free captive stocks of boreal toads from several key populations in the Southern Rocky Mountains. The primary location for housing of this captive stock presently is the Colorado Division of Wildlife's Native Aquatic Species Restoration Facility (NASRF), near Alamosa, CO. In order to minimize risk of losing all captive stock to an unforeseen die-off or accident, and to promote more effort towards development and testing of captive propagation and rearing techniques, selected stocks of toads are also housed at several other facilities, including the Saratoga National Fish in Wyoming, and at various AZA certified zoos, including, as of February 2006, the Henry Doorly Zoo (Omaha, NE), the Cheyenne Mountain Zoo (Colorado Springs, CO), the Cincinnati Zoo (Cincinnati, OH), and the Toledo Zoo (Dayton, Ohio). The primary purpose of establishment of captive stocks is to preserve genetic diversity in the event of catastrophic die-offs. Secondarily, captive stocks will be used to develop and test propagation and rearing techniques, and to provide source stock for possible future reintroductions to areas where the species has been extirpated. In December 2002, revised husbandry methods for NASRF were summarized in the "Native Aquatic Species Restoration Facility Boreal Toad Husbandry Manual."

Colorado Native Aquatic Species Restoration Facility (NASRF)

Currently 1,352 toads are at NASRF, of which 665 are potential brood-stock and 687 are being held in relation to on-going research projects. NASRF houses representatives from 19 different boreal toad breeding localities throughout the state. In the spring of 2005, NASRF produced 25 egg masses from captive stock representing 15 lots. The Grand Mesa translocation project received 3,846 captive bred tadpoles, 2,917 Chaffee county origin/hatchery reared tadpoles, and 1,076 Chaffee county origin/hatchery reared toadlets. Also, 465 toadlets and 44 adults were transferred to other research projects.

Other boreal toad related activities that occurred at NASRF in 2005 include:

- Evaluation of several hormone regimens for captive breeding program;
- Genetic samples collected from 251 toads representing 31 lots;
- Random Bd samples collected from 30 toads, all tested negative;
- Tanks purchased to increase summer production and brood stock capacity; and
- Drilling of a replacement well on facility, final water testing pending.

Saratoga National Fish Hatchery

On December 18, 2000, Saratoga National Fish Hatchery (SNFH) received official notification of approval from the Director, U.S. Fish and Wildlife Service, to house in refugia and breed Boreal toads (*Bufo boreas boreas*). Due to the increased loss of boreal toads housed at Sybille Wildlife Research Center (Sybille), the Wyoming Game and Fish Department, along with the Boreal Toad Recovery Team, made a decision to move all remaining captive populations from Wyoming of the Southern population Boreal toads to SNFH. The Hatchery received 1 male and 3 female Bird Creek boreal toads on December 12, 2001.

On July 28, 2001, at the direction of the Wyoming Game and Fish Department, a private landowner from Ryan Park delivered a female boreal toad to SNFH. In July 2002, U.S. Forest Service employees delivered 3 juvenile boreal toads to SNFH. One of these toads died in March of 2003 with a ruptured stomach, leaving one female and one male from this group.

Four more juvenile boreal toads were delivered by the U.S. Forest Service during the summer of 2003 from Ryan Park. There is one female and 3 males in this group.

In July 2003, the U.S. Forest Service delivered 5 juvenile boreal toads from Sourdough Creek. Three of these toads died between August 12th and August 15th. The necropsy report from Dr. Allen Pessier states that they died from chytridimycosis. While the possibility that infections were acquired in captivity at Saratoga N.F.H. can not be completely excluded, strong consideration should be given to the possibility of chytridimycosis in wild populations of boreal toads in Wyoming.

In an attempt to improve breeding success at SNFH, 2 male and 2 females toads are being hibernated during the winter of 2004-2003.

Boreal toads at Saratoga National Fish Hatchery (as of February 2005)

	Male	Female	Unknown
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Bird Creek boreal toads	1	3	0
Ryan Park boreal toads	4	3	0
Sourdough Creek boreal toads	1	1	0

Cheyenne Mountain Zoo

In 1993, personnel from the Cheyenne Mountain Zoo, in Colorado Springs, collected three yearling toadlets and 17 tadpoles from the Denny Creek breeding site, in Chaffee County, Colorado. These tadpoles were reared to metamorphs at the zoo, and some were over-wintered in a Percival Environmental Chamber. As of late 1997, all boreal toads at the Cheyenne Mountain Zoo had died due to unknown causes.

In 2000, the Cheyenne Mountain Zoo, in cooperation with the Colorado Division of Wildlife, has revived its effort to captive rear boreal toads. Twenty toads (10 from each of two different lots of eggs collected at Hartenstein Lake, and reared at the CDOW's Native Aquatic Species Restoration Facility) have been provided to the Cheyenne Mountain Zoo for captive rearing and propagation work. As of February, 2006, three of these toads remained alive.

Henry Doorly Zoo

Due to the limited number of known breeding boreal toads remaining in the San Juan Mountain area as of the mid 1990s, it was thought advisable to attempt to establish a captive brood stock of boreal toads from that geographic area. In 1996, the Henry Doorly Zoo, in Omaha, Nebraska, obtained boreal toads from Colorado for experimental propagation projects. Forty toadlets, originating from Mineral County, Colorado, were sent to the zoo. Most of these died within the first two to three months due to unknown causes. As of late 1997, three boreal toads (one male and two females) remained in captivity at Henry Doorly Zoo. Unfortunately, these three toads died of unknown causes in 1998. The CDOW provided 10 metamorph toadlets, taken from the Jumper Creek site in Mineral County, to Henry Doorly Zoo in August, 1998, to be used for further captive rearing and breeding work. Ten additional toadlets from 2000 egg masses were sent to Henry Doorly Zoo. As of March 2004, a total of nine toads were still alive.

Toledo Zoo

In October, 2000, one lot of 10 toadlets from the North Fork of Morrison Creek breeding locality, and one lot of 12 toadlets from the West Trout Creek breeding locality were sent to the Toledo Zoo, in Ohio. As of September 2002, thirteen toads were alive and in good condition.

In addition to the toads at the locations mentioned above, there are boreal toads at several other sites, primarily being used for educational, display, and research purposes. These include (1) Colorado's Ocean Journey, in Denver, (2) Colorado Division of Wildlife, in Ft. Collins, and (3) the Cincinnati Zoo, in Cincinnati, Ohio. Some toads will also be provided to specific members of the IRCEB (Integrated Research Challenges in Environmental Biology - National Science Foundation) group, for essential research on the chytrid fungus.

Experimental Translocations

Prior to the development of specific guidelines for translocations and reintroductions of boreal toads, in 1999, some translocations did take place. Although these were, in general, done according to acceptable standards, they did not follow strict and consistent protocols, which should be adhered to for any future translocations.

In August of 1993 and 1994, 44 and 200 boreal toadlets, respectively, were released near **Caribou**, in western Boulder County, CO, to determine if such releases could ultimately result in creation of a new breeding population at a site at which toads historically existed, but at which no toads had been seen in 20 years. The source of the tadpoles was a breeding site along Interstate 70, west of Denver, in Clear Creek County. The toadlets were released about a month after metamorphosis. They were fed as much as possible during the entire time they were being raised in order to maximize their growth and their chances of surviving the first winter. One-day surveys in 1995 and 1997 indicated that sub-breeding sized individuals were still present in the area. In 1998, males from the first cohort should have been of breeding size. No surveys were conducted in the area in 1998, and brief surveys in 1999 and 2000 failed to find any toads at the site.

Glacier Basin, in Rocky Mountain National Park, was the site of an experimental translocation of boreal toads, which began in 1995. It is a cooperative effort between Rocky Mountain National Park and the USGS/Biological Resources Division. Toadlets (n=800) were released in 1995, and egg masses and 100 captive-reared toads were translocated in 1996. The stock for this transplant came from the Lost Lake breeding site, in Rocky Mountain National Park (See Muths et al., 2001).

From 1997 through 2000, NPS and USGS/BRD staff continued to monitor the Glacier Basin site. No egg masses or tadpoles have been found to date. Although three adult female toads were observed in 1999, no male toads or breeding activity were seen. Surveys were conducted in the Glacier Basin area in 2000, but no toads or breeding activity were observed.

In 1995, 1996, and 1997, several thousand boreal toad toadlets, and several adult toads, and some tadpoles were released at **Lost Lake, Boulder County**, to determine if translocation of large numbers of young toads is an effective reintroduction method, to monitor the dispersal behavior and habitat use by the reintroduced toadlets, and to assess the survival rates of various age classes of toads. The transplanted animals originated from eggs taken from the Henderson Mine site, in Clear Creek County, and reared at the CDOW's Research Hatchery, in Bellvue, CO (see Loeffler, ed. 1999 for a complete report). This locality will continue to be monitored for several years to determine the result of the translocation. No toads have been observed at Lost Lake since 1999, although some monitoring has continued through 2004.

In Wyoming, an experimental reintroduction at the **Lake Owen** site, in Albany County, was initiated. In 1996, 4000 captive reared tadpoles, which originated from eggs taken at the Bird Creek breeding site, were released at Lake Owen. In 1997, an additional 1500 captive-reared tadpoles were released, and three one year old toads were observed, indicating that there was some survival of toadlets from the 1996 release. No additional toads have been released since 1997, but plans are to monitor the site for the next few years to determine the success of the reintroduction effort. Surveys at the site in 2000-2002 found no toads or sign of breeding activity.

Love Lake, in Mineral County, CO, was the site of a release of approximately 300 newly metamorphosed toadlets in early August, 1996. These were captive reared toadlets from tadpoles collected at the nearby Jumper Creek site in Mineral County. Subsequent searches during late summer of 1996 found some live and some dead toadlets at the site. No toadlets were seen during surveys at the site since 1996. Monitoring at this location should continue, however, due to its relative proximity to the Trout Creek population.

Grand Mesa, in western Colorado, was intensively surveyed from 1997 to 1999, and became a high priority site for an experimental reintroduction of boreal toads. In addition to intensive aquatic habitat mapping, approximately 780 hours of inventory effort was expended in historically occupied habitats on Grand Mesa in 1998. No toads, eggs, or larvae were found. Six potential reintroduction sites were selected from 80 possible sites, using standardized criteria. Administrative groundwork for initiation of an experimental translocation was started in early 1999, but the project was put on hold due to the finding of Bd in Clear Creek County, and evidence of the presence of Bd in at least two other populations. Some initial testing of resident amphibians has been conducted at the Kanah Creek drainage (Mesa County), with no Bd positive specimens of tiger salamanders or chorus frogs in 2002. During a January, 2003 meeting of a subgroup of the Boreal Toad Recovery Team and Technical Advisory Group, it was determined that an effort would be made to experimentally translocate eggs and/or tadpoles derived from Hartenstein Lake (Chaffee County) in 2003. Between June 25th and August 29th, 2003, over 13,000 tadpoles and 800 toadlets were released at the site over the summer of 2003, and again in 2004 as part of a CDOW research project led by Kevin Rogers. Unfortunately, recent testing of resident chorus frogs for *Batrachochytrium dendrobatidis* by PCR revealed the site to be positive for the chytrid fungus, yet some of the toads released in 2003 were located in 2004. Research and monitoring will continue at this site in 2005.

Additional areas are being investigated for potential translocations, including sites in Rocky Mountain National Park and historic habitat in New Mexico.

* * *

RESEARCH

Chaffee County Mark-Recapture Study

Brad Lambert, Colorado Natural History Program (CNHP), Ft. Collins, CO

In 2005 we continued a mark-recapture study in the Cottonwood Creek drainage in Chaffee County. The following breeding sites were monitored with multiple visits to collect data on the adult populations for the study: Collegiate Peaks Campground, Denny Creek, South Cottonwood, South Cottonwood West, Morgan's Gulch, Rainbow Lake, Hartenstein Lake, Holywater beaver ponds and Middle Cottonwood Creek. The purpose of this study is to collect baseline data for evaluating population size and trends, and to detect toad movement between breeding sites.

Since 1998, 978 adult males and 297 adult females have been tagged in the Middle Cottonwood Creek and South Cottonwood Creek drainages. Through 2005, there have been 2,244 recaptures (multiple recaptures of single individuals were included). Adult captures continue to be high at the Denny Creek/Hartenstein Lake sites and at the South Cottonwood Creek sites. There has been no apparent decline in the Cottonwood Creek metapopulation since this study began, although breeding success and adult high counts have fluctuated from year to year at several breeding sites. Rainbow Lake and the Holywater Beaver Ponds site have both shown no evidence of breeding since 2003 and low numbers of adults. These sites are of concern for being long term viable breeding sites, but also just might be marginal sites on the edge of the more robust core sites along Middle Cottonwood Creek.

Preliminary analysis of the data suggests that boreal toads from the Chaffee County sites show a high degree of breeding site fidelity. Despite most of the breeding sites in the Middle and South Cottonwood Creek drainages being closely situated, only 28 out of 698 toads that have been recaptured at least once were captured at different breeding sites (see Table 1). In the course of this study only two females have been found to move to a different breeding site.

The data reveals that, although rare, there is movement by toads along the Middle Cottonwood Creek sites and between the South Cottonwood Creek and South Cottonwood Creek West sites. One notable adult male was tagged at Collegiate Peaks Campground in 1999 and was recaptured in 2002 at the South Cottonwood Creek site approximately 8 km away. This is the first time there has been any evidence of movement between the population in the Middle Cottonwood Creek drainage and the population in the South Cottonwood Creek drainage. Ten adult males have been recaptured every year since this project began (1998 – 2005) and an additional 13 adult males tagged in 1998 were recaptured in 2005. Given that there were adults at the time they were tagged in 1998 they are at least 10 years old now. One adult male at Collegiate Peaks Campground has been captured 27 times between 1998 and 2005.

As a result of the mark-recapture study, breeding cycles in females have also been examined. Data from Chaffee County 1998-2005 shows evidence that females are likely to skip a year or more in between breeding; assuming that a breeding site visit by an adult female in the spring equals a

breeding attempt. There have been 44 recaptures of adult females in separate years: 23% (n=10) were captured in consecutive years, 52% (n=23) were captured in alternate years, and 25% (n=11) were captured after an absence of two or more years from the breeding site. The majority of females captured in consecutive years were at the Denny Creek site, which also appears to have a larger female resident population than other sites in Chaffee County.

Currently, the data from the 1998-2005 seasons are being pooled to see if survival estimates can be obtained through an open population model, such as Cormack's Jolly Seber model. Some modeling exercises are also being conducted to see if the 2001-2005 data can be fit into a robust design closed population model for survival rates, and population estimates.

In 2005, CNHP collaborated with the USGS on a paper involving data from the Denny Creek site and the RMNP sites. Several models were developed to examine the probability of male toads to return to a breeding site. The data suggested that male toads do not return to a breeding site every year with at least 10% of the toads emigrating temporarily from the breeding site.

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Table 1. Movement between breeding sites

Initial capture location and year	Recapture location and year	Approximate straight line distance (km)	Sex
Hartenstein Lake - 1998	Denny Creek – 1999	3	M
Hartenstein Lake – 1998	Denny Creek - 1999, 2000, 2001	3	M
Collegiate Campground – 1999	South Cottonwood - 2002, 2003	8	M
Denny Creek - 1998, 1999	Middle Cottonwood – 2001, 2002, 2003	2	M
Denny Creek – 1999	Denny Creek West– 2001	2	M
Denny Creek – 1999, 2000, 2001, 2002	Denny Creek West – 2002, 2003, 2004	2	M
Hartenstein Lake – 1998, 2001, 2002	Denny Creek – 2004	3	M
South Cottonwood – 1998, 1999, 2000	South Cottonwood West – 2004	2	M
Mineral Basin (not a breeding site) – 1999	Morgan’s Gulch – 2000	3.2	F
Middle Cottonwood – 2003	Collegiate Campground- 2004	2	M
Middle Cottonwood - 2002	Collegiate Campground – 2003	2	F
Denny Creek South – 2001	Denny Creek – 2002	1	F
Denny Creek West – 1999	Denny Creek – 2001	2	M
South Cottonwood West – 1999	South Cottonwood – 2000	2	M
South Cottonwood West – 2001, 2002, 2003	South Cottonwood – 2004	2	M
Collegiate Campground – 2002	Middle Cottonwood – 2003, 2004	2	M
Denny Creek South - 2001	Denny Creek – 2002, 2003, 2004	1	M
Hartenstein Lake – 1999, 2001, 2002	<u>Denny Creek – 2004</u> Middle Cottonwood 2005	<u>3</u> 2	M
Holywater Beaver Ponds – 2003	Middle Cottonwood – 2005		M
Denny Creek – 2001	Denny Creek West – 2005	2	M
Denny Creek – 2001, 2003	Collegiate Campground – 2005	4	M
Denny Creek South - 2000	Denny Creek – 2005	1	M
South Cottonwood – 2002, 2003	South Cottonwood West – 2005	2	M
Hartenstein Lake - 2001	<u>Denny Creek – 2003</u> Collegiate Campground – 2004, 2005	<u>3</u> 4	M
Denny Creek West - 2004	Denny Creek – 2005	2	M
Middle Cottonwood - 2004	Collegiate Campground – 2005	2	M
Middle Cottonwood - 2004	Collegiate Campground - 2005	2	M

The importance of diet on growth and survival to metamorphosis of boreal toads *Bufo boreas* in captivity

Jenn Logan and Kevin Rogers, Colorado Division of Wildlife

The Colorado Division of Wildlife's Native Aquatic Species Restoration Facility (NASRF) plays a critical role in State's efforts to restore boreal toads. This facility provides the key link to providing animals for repatriation efforts and research, as well as serving as a genetic bank for this threatened species. Refining husbandry practices at the facility will ensure the vitality of boreal toad restoration programs. We initiated a study that considered six diets in an effort to improve growth and survival to metamorphosis on tadpoles raised at NASRF.

Each of twelve tanks received 35 boreal toad tadpoles (Gosner stage 23) then randomly assigned one of four treatments (diets) in 2004. The experiment was repeated in 2005 with two of the four treatments representing novel diets. These diets included various combinations of Mazuri Feed (Mz; Mazuri® Purina Mills, St. Louis, MO), a mix of vegetables (mustard greens, collard greens, yellow squash, and zucchini) that were blended then frozen in to cubes (Vc), brine shrimp (Bs), and liquid vitamin B complex (B). Tadpoles were fed daily, and growth was monitored at roughly two-week intervals. Individual tadpoles were measured for total length, while an average mass for each individual was estimated by weighing all individuals in each tank simultaneously. Mortalities were noted and removed daily. Timing and mass at metamorphosis was also noted, as was metamorphic snout-vent length.

Interestingly, the commercially available tadpole food (Mz) was least effective in promoting growth and survival of the diets used. Weight gain was almost half what it was for our best diet (MzVcB), and length at metamorphosis was smaller as well. Perhaps more importantly, only a third as many tadpoles actually metamorphosed under the Mz diet as compared to the MzVcB group. Performance of the VcBs and MzVc diets was generally intermediate, though the VcBs group shared very high survival to metamorphosis with the MzVcB group. Interestingly, trace amounts of vitamin B were present in the Bs treatment, perhaps eluding to the importance of the role vitamin B plays in the developmental process. That finding guided the selection of feeds in 2005, where vegetable cube only (Vc) was least effective with the fewest number of tadpoles completing metamorphosis. Again, MzVcB surfaced as the best diet with total weight gain more than twice as much as the other diets. Vc, VcBsB and VcBs all resulted in metamorphs of similar length, mass, and days to metamorphosis. While MzVcB completed metamorphosis in nearly half of the days required for the other diets. Size and weight at metamorphosis was also larger for MzVcB than any other diet. The VcBs and MzVcB treatments again shared high survival to metamorphosis despite using pure brine shrimp, without trace vitamin B as in 2004. Unexpectedly, VcBsB resulted in fewer metamorphs than VcBs. The variability in growth and survival attributed to these diets underscores the importance of continued work in this arena.

Looking for reservoirs of *Batrachochytrium dendrobatidis* infection

Joel Wixson and Kevin Rogers, Colorado Division of Wildlife

An increasing range-wide interest in reintroducing boreal toads back in to historic habitats has spurred the need to develop a test for the presence of the chytrid fungus *Batrachochytrium dendrobatidis* (Bd). Repatriation efforts are time consuming and costly, and their success may hinge on the disease status of a potential site. As such, it is imperative that the disease status be considered when evaluating potential reintroduction efforts. This process is further complicated by the fact that many of our most promising sites currently have no resident amphibian species. Since Bd can persist at a location even in the absence of amphibian species, we suspect that amphibians may not be the only host, and that infection can be maintained through other organisms. We looked previously for infection in aquatic insects and other invertebrates, but were unable to detect the pathogen. Upon hearing that other researchers were able to detect the signal on fathead minnows, we embarked on a more rigorous examination of potential alternate hosts including fathead minnows (*Pimephales promelas*), goldfish (*Carassius auratus*), rainbow trout (*Oncorhynchus mykiss*), feathers, and pure keratin.

Four pens were constructed to house the fish, and set in known Bd positive ponds along with six mallard flank feathers and four teabags containing pure keratin. Fish were swabbed, scraped, and fin clipped 1 day, 3 days, 7 days, and 14 days after exposure. Mallard feathers and keratin samples were also collected on the same sampling days, along with water temperature. The presence of Bd was confirmed at the sites, by swabbing 20 resident chorus frogs *Pseudacris triseriata* at the same time. DNA was extracted from the samples following a standard spin column protocol (John Wood, Pisces Molecular). All sample DNA preparations were assayed for the presence of the *B. dendrobatidis* ribosomal RNA Intervening Transcribed Sequence (ITS) region by 45 cycle single-round PCR amplification.

Only a portion of the samples representing those most likely to return a positive signal were assayed for the presence of Bd to reduce cost. Even among those samples, no Bd DNA was detected on the keratin, mallard flank feathers, or goldfish swabs. We did detect positive signals in all five samples of swabbed fathead minnows from a pen at a single pond on the Grand Mesa, CO (Cow Camp) the day after exposure. Unfortunately, that signal was not found in the other three pens also placed in Bd positive sites, nor was it detected in subsequent sampling efforts at Cow Camp (day 3, 7, or 14). While it may be possible to detect Bd by swabbing sentinel fathead minnows, it does not appear to be a very sensitive environmental test.

Repatriation of boreal toads *Bufo boreas* on the Grand Mesa, Colorado
Kevin Rogers and Carrie Slubowski, Colorado Division of Wildlife

This study explores the efficacy of introducing various boreal toad life stages to establish new populations. The study site lies in the Kannah Creek drainage on the southern end of the Grand Mesa in Mesa County, Colorado. The site is comprised of half a dozen small ponds in close succession that provide a number of potentially suitable breeding areas with excellent breeding shallows. The site was thought to be negative for *Batrachochytrium dendrobatidis* (Bd) based on initial PCR testing of resident amphibians (chorus frogs *Pseudacris triseriata* and tiger salamanders *Ambystoma tigrinum*) in 2002, but subsequent tests on older chorus frogs did reveal Bd infection in 2003. Despite the positive status, it was decided that enough useful information could be gleaned from the study to continue with the initial three-year release protocol.

Approximately 20,000 eggs from over a dozen clutches were harvested from the Chaffee County boreal toad metapopulation in late May of 2003 and 2004. These eggs were brought to the Native Aquatic Species Restoration Facility (NASRF) in Alamosa, CO and reared to a Gosner stage 25. Egg production from the brood stock at NASRF in 2005 was sufficient to cover 60% of the animals needed for release. These represented eight captive clutches from the Chaffee County metapopulation. Portions of four clutches were brought in from Denny Creek to produce the remaining 40%. Genetic material from each clutch was preserved for future analysis if necessary. Twelve thousand tadpoles were released unmarked around the margins of three ponds at the study site in late June of each year (only 7,000 in 2005). An additional 1200 were divided among six pens (two per pond), raised to metamorphosis, toe clipped for future identification, and released in 2003, 2004 but not 2005. Remaining tadpoles were kept at NASRF until approximately 3 weeks post metamorphosis. Nine hundred were then given a different toe clip and divided among the same three ponds in late August of each year.

The release sites were monitored weekly again in 2005, using visual encounter surveys around the perimeter of each pond and neighboring uplands. Though we detected fewer Age 1 toadlets than in 2004, their presence was confirmed on a number of occasions, as was an Age 2 individual. We did not expect to find large numbers of sub-adult animals, as they disperse from the breeding site after hatching, and generally do not return until they are ready to breed. Of the animals born in 2005, those released directly into the wild as tadpoles were substantially larger in late summer than those released as three-week old toadlets. Though hatchery reared toadlets were fed *ad libitum*, the ability of wild released tadpoles to behaviorally thermoregulate apparently translated into increased growth. It was thought that this increase in mass would confer some fitness advantage, suggesting that wild released tadpoles would be the most suitable life stage for subsequent repatriation efforts. Interestingly, this increased size going in to winter did not seem to affect survival to the following summer, as individuals from all release groups were recovered in proportion to numbers released the previous year.

Status of *Batrachochytrium dendrobatidis* infection and survival of boreal toads in the Urad Valley, 2005

Lauren J. Livo, University of Colorado at Boulder

The amphibian pathogen, *Batrachochytrium dendrobatidis* (referred to hereafter as *Bd*), has been observed in boreal toads (*Bufo boreas*) in the Urad Valley (Clear Creek County, Colorado) since 1999. A PCR test is available for detecting this pathogen from skin swabs taken from boreal toads. This technique permits multiple non-lethal samples to be obtained from individual toads throughout their activity period.

General findings

In both 2004 and 2005, I placed radio transmitters on boreal toads in the Urad Valley (1.9 g Holohil Systems BD-2). I would relocate the toads once per week; when a toad was accessible, I would obtain a skin swab from it to test for *Bd*.

Key observations from the past two field seasons include:

- There is a seasonal peak of *Bd* infection in June in both years.
- Animals found with infections in 2004 had apparently cleared the infection by late in the activity season, survived overwinter, and reappeared at breeding areas in 2005.
- Males are capable of fertilizing more than one egg mass per season.
- There was no observed PIT tag loss among toads tracked with radio transmitters in either year, contrasting with high PIT tag loss rates at the Native Aquatic Species Restoration Facility.

Mine Water

Effluent liquid from the Henderson Mine is transported via underground pipes to the Urad Valley where it is treated. Toads found at ponds within a berm containing treated mine water effluent in 2005 were more likely to survive the activity season than toads found elsewhere in the Urad Valley, suggesting that one or more components of the effluent acted to suppress or kill *Bd* in boreal toads.

An analysis of samples of this mine water was provided by Stephen Brinkman of the Colorado Division of Wildlife. The table below shows the mean concentrations of a variety of metals compared to concentrations in tap water.

Table 1. Metal concentrations (ppm) found in mine water effluent vs. tap water.

	Al	Ca	Cd	Cu	Fe	Mg	Mn	Pb	Se	Zn
Mine	2268	120919	2.11	<1	1134	13904	55900	8.1	19.6	1487
Tap	25	9317	<0.15	421	<10	1215	<10	10.3	<5.0	361

Al (Aluminum), Ca (Calcium), Cd (Cadmium), Cu (Copper), Fe (Iron), Mg (Magnesium), Mn (Manganese), Pb (Lead), Se (Selenium), Zn (Zinc).

It is notable that, although toads are often present in the ponds behind the berm (and thus affected by mine water effluent), neither tadpoles nor metamorphs have been observed in these ponds. Whether this indicates that toads elect to deposit egg masses at other sites or that clutches

deposited in these ponds do not survive is unknown.

On two occasions, I removed small portions of egg clutches to test whether mine water affected hatching rates. Eggs from the Treatment breeding locality were collected on June 13, 2005; eggs from the Power Alley site were collected on June 21, 2005.

Approximately 3 cm of egg strand containing 23 to 55 live eggs (mean 36 eggs, ± 1.562 SE, $N = 20$) were placed in each container. For each of the two trials, 5 containers were randomly assigned to contain 200 ml 20% Holtfreter's solution, pH 6.5 (an artificial pond water) versus 5 containers assigned to contain 200 ml freshly collected treated mine effluent.

The egg sample from the Treatment site had an overall hatching rate of 89% (± 0.036 SE, $N = 10$). In contrast, a mean of only 30% of the eggs from the Power Alley site hatched (± 0.065 SE, $N = 10$). Although there was a significant difference in hatching rate due to the source of the eggs, there was no difference between hatching rates in Holtfreter's solution versus mine water effluent (see figure below). This indicates that, at least for early exposure, mine water effluent had no deleterious effects on embryonic development to hatching.

Despite the apparent lack of effect from the mine water effluent on tadpole hatching rates, other studies have found significant deleterious effects on growth and development for anuran larvae exposed to various metals. To date, no tests have been performed to determine whether growth and survival to metamorphosis of boreal toad tadpoles might be affected by development in mine water effluent. However, studies of the effects of selected single metals on boreal toad tadpoles indicate strong negative effects on growth and mortality (Brinkman 1998).

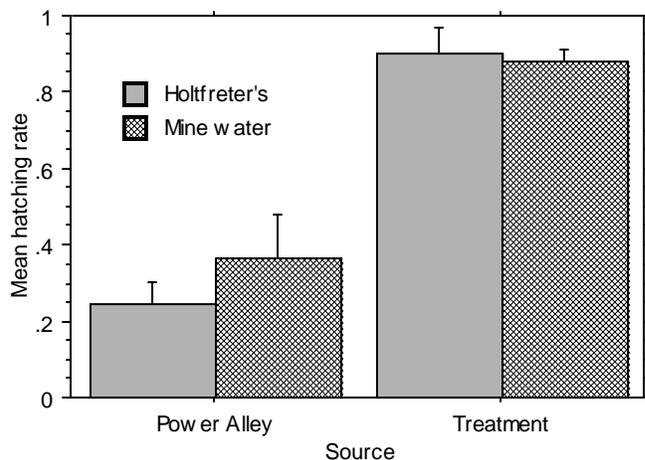


Figure showing mean hatching rates for eggs from Power Alley versus Treatment, and maintained in Holtfreter's solution versus mine effluent water.

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Laboratory exposure trials of boreal toads to *Bd*

Lauren J. Livo and Cindy Carey, University of Colorado at Boulder

Geographic origin effects

Boreal toad populations in Colorado have a variety of exposure histories to the amphibian pathogen *Batrachochytrium dendrobatidis* (referred to hereafter as *Bd*). For some populations, such as those in the Urad Valley (Clear Creek County, Colorado), exposure to this pathogen has been continuous since 1999, while the Buck Mountain population (Routt County, Colorado) has been exposed to *Bd* since 2004. In contrast, the Denny Creek (Chaffee County, Colorado) population has no known exposure to *Bd* to date.

This experiment was designed to test whether prior exposure of boreal toad populations to *Bd* influenced survival of toadlets after exposure to *Bd*. In June, 2005, I collected egg samples from 2 (Buck Mountain) or 4 (Urad Valley and Denny Creek) individual clutches at breeding areas. These 10 lots of toadlets were reared at the Native Aquatic Species Restoration Facility for this experiment. An effort was made to maintain the same number of toadlets for each lot, as density affects growth rates and toadlet size. In January 2005, 20 toadlets from each lot were transferred to the University; after some mortality in transit, 75% of the remaining 194 toadlets were randomly assigned to exposure groups and the remaining 25% served as controls.

In the exposure groups, toadlets were housed for 24 hours in a solution containing an estimated 1 million *Bd* zoospores, while control toadlets were housed for 24 hours in a solution that lacked *Bd* zoospores but was otherwise identical. After this exposure period, all toadlets were housed individually in plastic containers holding 20 ml of 20% Holtfreter's solution. The experiment began on January 25, 2005.

Although this experiment is not completed, a logrank test of the survival curves among toadlets exposed to *Bd* indicates significantly higher mortality rates for the Denny Creek toadlets than for either the Urad or Buck Mountain toadlets. Only two of the 48 control animals have died to date.

These results suggest that both Urad and Buck Mountain populations may already have developed some resistance to *Bd*. Possible mechanisms include variation in how porous the toads' skin may be to invasion by *Bd* zoospores or differences in immune system functions, such as variation in antimicrobial peptide type or production rates.

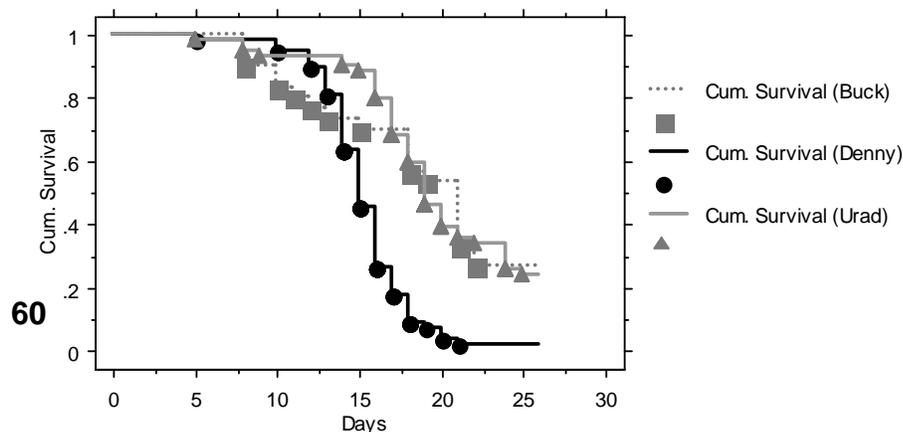


Figure showing the composite survival curves for toadlets from 3 geographic sources.

Although the

survival curves for exposed populations are offset from that of the naïve population, even toadlets from the exposed populations remain highly susceptible to mortality from *Bd*.

Mine water

To test whether the survival of juvenile boreal toads exposed to *Bd* was affected by some component in mine water effluent, we conducted trials using surplus toadlets from the Colorado Division of Wildlife's Native Aquatic Species Restoration Facility. These toadlets were assigned to groups that varied with respect to the toadlets being housed in mine water effluent versus housed in 20% Holtfreter's solution and being exposed to a solution containing an estimated 1 million *Bd* zoospores versus a solution that lacked *Bd* zoospores but was otherwise identical. The experiment was begun on February 2, 2005.

In previous experiments, small toadlets exposed to 1 million zoospores survive a mean of approximately 15 days (Carey et al. 2006), and controls treated the same way but not exposed to *Bd* had survival rates approaching 100 percent over the course of the experiment. However, in this experiment, toadlets began dying by day 4, with approximately 40 percent of both the exposed and control toadlets dead by day 8, when the experiment was terminated.

We attempted to run the experiment again, beginning on February 17. Again, we had high rates of early mortality in both exposed and control groups.

We sent some toadlet carcasses to Allan Pessier, who identified a nutritional imbalance (A. Pessier, personal communication). Consequently, we cannot use these data to either support or reject the possibility that mine effluent water influences patterns of mortality for toadlets exposed to *Bd*.

Acknowledgements: We thank Kevin Rogers, Tina Jackson, Jenn Logan and the staff of the Native Aquatic Species Restoration Facility for facilitating these studies. Jenn B. Bae, Cassia Rye, and Heidi Bustamante assisted with animal care and sample collection for the geographic origin experiment. Jamie Voyles and Barry Pederson assisted with animal care and sample collection for the mine water experiment. Allan Pessier performed necropsies on some of the toadlets submitted for evaluation.

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An evaluation of sampling protocols for *Batrachochytrium dendrobatidis* infection in wild chorus frogs (*Pseudacris triseriata*)

Kevin Rogers, Carrie Slubowski, Joel Wixson, and Boyd Wright, Colorado Division of Wildlife

An increasing range-wide interest in reintroducing boreal toads back in to historic habitats has spurred the need to develop a test for the presence of the chytrid fungus *Batrachochytrium dendrobatidis* (Bd). Repatriation efforts are time consuming and costly, and their success may hinge on the disease status of a potential site. As such, it is imperative that the disease status be considered when evaluating potential reintroduction efforts. Potential sites are often home to chorus frogs (*Pseudacris triseriata*), which have been shown to be reasonable surrogates for testing for the presence of Bd in the wild when boreal toads are absent. To refine the sampling procedures for detecting Bd in chorus frogs, we examined 1) the seasonality of infection, 2) relative sensitivity of scrapes, swabs, and toe clips, and 3) the number of belly-swipes needed to confidently detect Bd on an individual if present.

Twenty adult chorus frogs from three known Bd+ populations on the Grand Mesa, Colorado were sampled with swabs every other week throughout the summer to assess the strength and seasonality of the Bd infection. Following the peak of infection, a swab, scrape and toe clip sample were taken from each adult frog to evaluate the relative sensitivity of each method. Our default sampling procedure for detecting Bd in chorus frogs is to swab or scrape the belly 25 times. Since that many swipes can irritate the skin, particularly around the sensitive drink patch area, we explored reduced number of swipes to see if it is possible to detect the disease with confidence with fewer swipes. Each skin swab sample was mixed then spun at approximately 16,000 G for 3 minutes. The supernatant was drawn off and discarded, while any pellet was resuspended with the addition of tissue lysis buffer and vortexing. Total DNA was extracted from all samples using a spin-column DNA purification procedure. All sample DNA preparations were assayed for the presence of the Bd ribosomal RNA Intervening Transcribed Sequence (ITS) region by 45 cycle single-round PCR amplification with appropriate controls.

As in 2004, infection in adult chorus frogs did decline over the course of the summer in 2005 in three ponds on the Grand Mesa. Prevalence of Bd was as high as 95% in late June, then dropped to less than 20% by late August. Swabs were more sensitive than scrapes in five trials, indicating both higher Bd prevalence and stronger intensity of infection. Both techniques were much less sensitive than analyzing toe clips. The first swab on a frog provided the most information on prevalence and infection intensity, while swiping 3, 5, and 10 times did nothing to improve the sensitivity of the test. Twenty swabs did mildly enhance the ability to detect infected individuals, and should be retained as a standard. To assess the suitability of a site in Colorado for repatriation efforts, we recommend sampling sentinel animals early in the season, using swabs rather than scrapes, and restricting the sampling effort to chorus frogs unless they are unavailable, as Bd appears to be more difficult to detect in tiger salamander populations. While very sensitive, toes clips should only be sampled to confirm absence of Bd on high priority sites. Not only are toe clip samples less benign than swabs, they contain so much DNA that they tend to overwhelm the PCR test so that relative intensities of infection cannot be scored.

Tag retention in a captive population of boreal toads *Bufo boreas* using four marking schemes

Kevin Rogers, Carrie Slubowski, Craig Fetkavich, Jenn Logan, Colorado Division of Wildlife

The development of reliable marks to identify individuals or groups of boreal toads is critical to the success of research and captive breeding efforts on this species. Given the widespread use of various marking schemes, it is necessary to quantify the extent of the tag loss, to determine if it indeed poses a problem. The Colorado Division of Wildlife's Native Aquatic Species Restoration Facility (NASRF) in Alamosa lends itself to this sort of research, as large numbers of toads can be tagged and retention evaluated on a regular basis.

Over 300 captive boreal toads were used in this study. Adults received passive integrated transponders (PIT), visual implant elastomer (VIE), coded wire, and toe clips. Toadlets were subjected to the same treatment without the PIT tags. The PIT tags are uniquely coded and ideal for identifying specific individuals required for breeding records as well as robust schemes for population monitoring. The remaining marks are more suitable as batch marks used to identify a group of individuals. While it is true that the coded wire tags have a unique sequence of numbers on them, reading those numbers requires that the tag be removed from the body and inspected under a magnifying glass. As such, they were simply used as a batch mark in this study, and were readily detectable with an electromagnetic wand waved over the animal.

All toads were inspected at six-week intervals for marks, unless they were in hibernation. PIT and coded wire tags were scored as being either present or absent, while VIE and toe clips were scored on a scale ranging from 0-3. A VIE score of zero represented no detectable VIE tag even under scrutiny with a blue light and amber tinted glasses, while a three was clearly visible to the naked eye. A toe clip score of zero indicated complete regeneration of the toe without any deformity, while a three was assigned to toes with no evidence of regeneration and a clearly recognizable mark.

Both VIE and toe clips worked well as batch marks for small toadlets (mean snout-vent length at tagging = 19.5 mm) with both displaying better than 99% retention over four months, and 96% and 99% respectively after one year. The coded wire marks worked well initially, but loss accumulated over time so that 14% of the toadlets were without tags after 4 months, and 24% after one year. Retention of batch marks in adult toads for one year ranged from good to excellent, with VIE marks recognizable in 89% of the toads, coded wire in 94%, and toe clips in 99%. Retention of the PIT tags was very disappointing, with 30% losing their tags in the first month, 40% after two months, and a full 87% having lost their unique marks after one year. This degree of tag loss is unacceptable, and alternative methods for identifying individuals will need to be developed. With survival rates of wild PIT tagged boreal toads as high as 80%, it is clear that tag loss at the hatchery is curiously much greater than in the wild, and will need to be explored further.

HABITAT MANAGEMENT

Overview

Boreal toad habitat consists of areas with suitable breeding habitat in lodgepole pine, spruce-fir forests, and alpine meadows. Breeding habitat consists of shallow, quiet water in lakes, marshes, bogs, ponds, and wet meadows, often with egg placement optimizing thermal effects of the summer sun. Young toads are restricted in distribution and movement by available moist habitat, while adults can move several miles and reside in marshes, wet meadows, or upland forested areas. Although availability of adequate suitable habitat does not appear to be a significant factor in the decline of boreal toad populations, protection of such habitats and the preservation of reliable and stable water levels in breeding habitat, are essential to the long-term viability of toad populations.

Public Lands

The large majority of known existing and potential boreal toad populations and habitats in the Southern Rocky Mountains are located on US Forest Service lands and in Rocky Mountain National Park (see summary by geographic areas, earlier in this publication). Therefore, efforts to protect and enhance habitat for boreal toads are focused mainly on these lands.

At this time, protection and consideration of boreal toad habitats on US Forest Service lands is achieved via management guidance provided in various USFS documents, such as the Watershed Conservation Practices Handbook and the Region 2 Sensitive Species List. A significant number of known breeding populations are located within USFS Wilderness Areas and within Rocky Mountain National Park, which provides additional protection of habitats from potential disturbance by disruptive land uses. In addition, cooperative efforts with individual forests are pursued in localities where boreal toad breeding populations exist. These efforts are focused at informing recreationists about boreal toads and habitats, making land managers aware of the toads' habitat needs, and incorporating considerations for boreal toad habitat protection in land use decisions on forests. It is anticipated that specific direction for boreal toad habitat conservation measures will be incorporated in individual forest management plans after review under the National Environmental Policy Act (NEPA).

Private Lands

There are a few boreal toad populations and habitats located on private lands. In Colorado, the Colorado Division of Wildlife has worked with private land owners and developers, mainly in Summit, Clear Creek, and Grand counties, on cooperative efforts to protect existing toad populations and habitats. At the Cucumber Gulch site, in Summit County, cooperative work with the town of Breckenridge and a local land developer has resulted in the adoption of a number of conditions and criteria which will help to minimize any potential impacts on boreal toads at that site. This effort will help to set a precedent for consideration of boreal toad habitats in other pending land developments in Summit County. In 1998, Vail Associates helped fund boreal toad survey work in Summit County in cooperation with the USFS and CDOW. Vail Associates continues to work closely with several local,

state, and federal agencies to minimize potential negative impacts of planned development on boreal toads and on the Cucumber Gulch wetlands at the Breckenridge Ski Resort.

In Grand County, cooperative efforts with managers of the Pole Creek Golf Course have helped to gain consideration for boreal toads on that property, and managers of the golf course have agreed to pursue cooperative work to preserve and enhance the habitat at the two known breeding sites.

In Clear Creek County, the Climax Molybdenum Company has worked in cooperation with the Colorado Division of Wildlife at the Henderson/Urad Mine, since 1995, to help facilitate research work on boreal toads and to protect and enhance toad breeding habitat on their property.

Although the boreal toad populations on private lands represent a relatively small portion of the total toad population and habitat, efforts will continue to protect such sites and to minimize and mitigate impacts of land development and land use changes. To further this goal, the CDOW and USFWS have been working on creation of an Umbrella Candidate Conservation Agreement with Assurance. The approval of such an agreement would afford individual landowners the protections of a CCAA by signing a Certificate of Inclusion. Approvals of the draft agreement are still pending as of February 2006.

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