

**Surveys for Boreal Toads (*Bufo boreas boreas*)
in and near the
Northern Portion of the
Powderhorn Wilderness,
Gunnison and Hinsdale Counties, Colorado: Summer 2002**

**Final Report Submitted to the
United States Department of Interior, Bureau of Land Management
by the
Colorado Natural Heritage Program
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March 30, 2003



**Colorado
State
University**

Knowledge to Go Places

EXECUTIVE SUMMARY

Once common in the mountainous portion of Colorado, the boreal toad has experienced sharp declines in distribution and abundance throughout its range in the state during the past twenty years. Today it is classified as an endangered species in Colorado, where its current, reduced distribution is not well known. The U.S.D.I. Bureau of Land Management contracted the Colorado Natural Heritage Program to conduct field surveys during the summer of 2002 in selected mountain drainages near the town of Powderhorn, Colorado. A high-elevation marshy area and specified portions of five mountain streams in and near the northern Powderhorn Wilderness were surveyed for boreal toads during early June and again during mid-August. No evidence of boreal toad adults, larvae, or egg masses was found during 14 days of fieldwork. Habitat that appeared to be suitable for use by breeding boreal toads was found in locations throughout the study area, although most ponds and pools lacked specific habitat features that are present at most sites where boreal toads are known to breed in the southern Rocky Mountains. Boreal toads were probably not present on the study area during the summer of 2002. Few known predators of boreal toads were observed during field surveys. Brook trout, which probably do not prey heavily on boreal toads in Colorado, were abundant at all sites surveyed except Indian Creek, where no fish were observed.

INTRODUCTION

Historically, boreal toads (*Bufo boreas boreas*) occupied suitable habitats throughout most of the mountainous region of Colorado (Hammerson 1999), where they were very common (Ellis and Henderson 1915, Burt 1933, Burger and Bragg 1947, Blair 1951). Widespread declines in the distribution and abundance of boreal toads occurred throughout Colorado during the last two decades of the twentieth century (Carey 1993, Corn 1993, Livo and Loeffler 2003). Boreal toads are now extremely rare or entirely absent from most known, historical breeding sites in Colorado (Hammerson 1999). *Bufo boreas* was classified as a state endangered species by the Colorado legislature in November 1993. Today about 30 populations and about 60 breeding localities are known in Colorado (Livo and Loeffler 2003).

Current distribution of the boreal toad in Colorado is uncertain because the species has disappeared from many former breeding sites and because many locations in the state that may offer suitable habitat for boreal toads have never been surveyed. Wetlands in the mountains near the town of Powderhorn, Colorado may offer favorable conditions for the establishment and persistence of boreal toads. Numerous freshwater streams and ponds in the valleys within and near the northern portion of the Powderhorn Wilderness are located at elevations (8,500 – 11,500 feet) (Campbell 1970) and in forest types (ponderosa pine [*Pinus ponderosa*] and subalpine forests) (Hammerson 1999) that are typical of habitats known to support populations of *Bufo boreas boreas* elsewhere in Colorado. The U.S.D.I. Bureau of Land

Management (BLM) contracted the Colorado National Heritage Program to conduct surveys for boreal toads along specified stretches of mountain streams on BLM lands located about 25 miles to the southwest of the city of Gunnison, Colorado (Fig. 1). This report describes the areas that were surveyed for boreal toads, and it evaluates the suitability of those areas as potential habitat for boreal toads. It also presents the results of field surveys conducted during June and August 2002.

STUDY AREA

The study area consisted of specified portions of the watercourses within five mountain drainages and a high-elevation marshy area, on lands managed by the BLM within and adjacent to the northern part of the Powderhorn Wilderness in southern Gunnison County and northeastern Hinsdale County, Colorado. The area lies about 15 miles to the south of the eastern portion of the Curecanti National Recreation Area, which is located along U.S. Highway 50 about 9 miles to the west of the city of Gunnison, Colorado. The six specific areas that were surveyed for boreal toads were selected by the BLM after a search of the literature on the distribution and habitat use of boreal toads suggested that characteristics (e.g., elevation, vegetation, likely presence of suitable freshwater habitats for breeding and larval development) of these areas were similar to those reported for areas known to be occupied by boreal toads in the southern Rocky Mountains. The areas selected seemed likely to offer favorable habitat and other environmental conditions capable of supporting boreal toads.

Indian Creek – Representing the westernmost area surveyed for boreal toads, Indian Creek lies on BLM land to the north and west of the Powderhorn Wilderness (Fig. 2). The survey began at the northern (lower) end of the specified search area, at the point where Indian Creek crosses Gunnison County Road 58. It extended southward along the watercourse for about 2.2 miles and occurred within an elevational range of 9,200 – 9,400 feet. At its northern end, on the slopes along the eastern side of the drainage, the survey area was bounded by blocks of ponderosa pine and quaking aspen (*Populus tremuloides*) forest. Spruce-fir forest lined the remainder (most) of the eastern side of the valley. The western side of the surveyed portion of the Indian Creek drainage was bounded by Douglas-fir (*Pseudotsuga menziesii*) forest near its northern end, and by ponderosa pine and then spruce-fir forests farther upstream.

West Fork – An approximately 1.4-mile stretch of the West Fork of Powderhorn Creek, ranging in elevation from 9,840 to 10,160 feet was surveyed for boreal toads (Fig. 3). In this area, the Powderhorn Wilderness boundary runs along the bottom of the West Fork drainage: lands to the east of the drainage bottom lie within the wilderness, whereas those to the west of the drainage bottom are outside the

wilderness. Along most of the section of West Fork that we surveyed, both the eastern and western slopes were covered with dense aspen forest. On the eastern slope, the aspen forest extended to the top of the ridge (with widely-scattered conifers), indicating that the forest on the entire eastern slope had burned several decades before. Near the northern end of the surveyed stretch of creek, spruce-fir forest, which occupied higher elevations along most of the length of this drainage, extended all the way down both eastern and western slopes to the bottom of the drainage. At the northern tip of the surveyed area, aspen trees covered both eastern and western slopes.

Middle Upper – The upper section of the Middle Fork of Powderhorn Creek (Fig. 4) was the only survey area that extended from Gunnison County into Hinsdale County. Slightly more than 2 miles in length, this survey area included an elevational range of 10,000-10,400 feet. For most of its length, the drainage bottom in the survey area was lined on both sides by dense stands of aspen trees that covered the drainage’s lower slopes. At and near its southern (upstream) end, the surveyed area was bounded by spruce-fir forest along its southeastern side. Near its northern end, along the northwestern side of the drainage, Douglas-fir trees extended down the slope through a large block of aspen trees to the bottom of the drainage.

Middle Lower – The lower section of the Middle Fork of Powderhorn Creek (Fig. 5) was located about 1.1 mile downstream (to the north) from the “upper section” that was described above. About 2.5 miles in length, the “Middle Lower” survey area ranged in elevation from 9,000 to 9,280 feet. Throughout its length, the survey area was flanked by Douglas-fir forest that covered the lower slopes on both sides of the drainage.

Powderhorn Swamp – This park-like landscape feature was about 0.7 mile long (north to south) and about 0.15 mile wide at its widest point (Fig. 6). The slopes surrounding the swamp were nearly completely covered by dense aspen forest that colonized the area after an extensive fire. The south end of the swamp was bounded by a large stand of Douglas-fir trees. The swamp ranged in elevation from 10,000 to 10,400 feet, with most of the area being situated at about 10,200 feet. Topographic maps (photorevised in 1982) indicated that three ponds might be present within the swamp: two near the western edge and one near the northern end of the swamp.

East Fork – The East Fork of Powderhorn Creek (Fig. 7) probably receives more recreational use than the other areas surveyed for boreal toads, with the possible exception of Indian Creek. Proximity to the large, developed parking lot/camping area/trailhead at the southern end of Tenmile Springs Road is

probably responsible for the relatively high levels of use of the East Fork by hikers, fishermen, hunters, and other outdoor recreationists. The survey area included a stretch of valley floor about 2.1 miles long, extending southward from the vicinity of the Tenmile Springs trailhead to a point slightly to the south of the intersection of the trail that leads from East Fork to Powderhorn Swamp. For most of the length of the survey area, dense Douglas-fir forest covered the lower slopes on both (east and west) sides of the drainage. In contrast, the southernmost portion (about 0.3 mile) of the East Fork survey area was bounded on both sides by aspen forest. Elevations in the area ranged from 9,350 to 9,700 feet.

METHODS

Surveys for boreal toads were conducted during early June and again during mid-August in the six selected wetland areas in and near the Powderhorn Wilderness. Surveys consisted of careful visual searches for toads, larvae, and egg masses during slow walks along the edges of ponds and other bodies of water. Presence of *Bufo boreas boreas* at a site would be considered conclusive if an adult, larva, or egg mass were observed. Failure to detect the presence of *Bufo boreas boreas* is never conclusive. Boreal toads are especially difficult to detect because of their cryptic coloration and because the males lack a conspicuous breeding call (Hammerson 1999). Surveys to determine the presence of anurans and to estimate their densities generally rely on detecting the loud breeding calls of males that have congregated at breeding sites (Karns 1986, Heyer et al. 1994, United States Geological Survey 2003).

In this report, botanical nomenclature follows Weber and Wittmann (2001). Zoological nomenclature follows Robins et al. (1991) for fishes, Collins and Taggart (2002) for amphibians and reptiles, Wilson and Reeder (1993) for mammals, and the American Ornithologists' Union (1998) for birds.

RESULTS

No evidence of the presence of *Bufo boreas boreas* was found during the June and August field surveys in and near the Powderhorn Wilderness. No toads, larvae, or egg masses were observed in the five drainages or in the Powderhorn Swamp area. Although many local areas did not contain suitable breeding habitat for boreal toads, an abundance of such habitat was available in many areas within the survey area (Exhibit 1).

Indian Creek – Once home to a thriving colony of American beavers (*Castor canadensis*) that constructed dams and created a series of relatively shallow freshwater ponds, the Indian Creek drainage

bottom (Fig. 2) has been transformed into a mosaic of terrestrial habitats traversed by a creek. In 2002, much of the drainage bottom consisted of a series of dry, completely silted-in, senescent beaver ponds in various stages of secondary ecological succession. Indian Creek meandered along the valley floor, occasionally encountering old beaver dams and spreading to create small, shallow ponds. A few of these ponds probably would have provided favorable habitat for boreal toads. Many of the ponds, however, lacked certain habitat features that are critical for breeding boreal toads, such as northern shorelines that have emergent vegetation, shallow water, and gently-sloping bottoms.

Most of the ponds and pools present during the summer of 2002 were clustered near the midpoint of the stretch of Indian Creek that we surveyed. Upstream from this cluster of ponds and pools, no suitable habitat for boreal toads was found within the survey area. In many places, the valley floor was choked with dense vegetation dominated by willow (*Salix* sp.) and including trees such as Colorado blue spruce (*Picea pungens*) (Exhibit 2). Indian Creek flowed through this southern, upstream area in the form of a meandering stream that lacked ponds and pools. The northern (downstream) portion of the area surveyed along Indian Creek included several stretches of creek that were completely devoid of appropriate habitat for boreal toads. Several scattered ponds also were present, however, and in some cases, pond conditions seemed to be favorable for breeding boreal toads. Throughout the Indian Creek survey area were former beaver ponds that had become terrestrial habitats densely carpeted with lush grasses.

Evidence of very limited and localized activity by beavers was observed at a few sites along Indian Creek (both northern and southern portions) during the June survey, but no signs of recent beaver activity were seen in August. Cattle (cows and calves) were seen grazing throughout the Indian Creek survey area during the August (16th and 18th) survey, and two cowboys on horseback were observed herding cattle along Indian Creek after the completion of the survey on August 16. Indian Creek was the only survey area in which no fish were seen during the boreal toad survey. Large numbers of brook trout (*Salvelinus fontinalis*) were readily observed throughout the waters of the other five sites during June and August.

West Fork – Growing on the relatively moist soils of the drainage bottom along the West Fork of Powderhorn Creek (Fig. 3) were scattered ponderosa pine, Douglas-fir, blue spruce, Engelmann spruce (*Picea engelmannii*), and subalpine fir (*Abies bifolia*) trees. Situated on the valley floor was a nearly continuous series of active and (mostly) inactive beaver dams and ponds (Exhibit 3). The presence of freshly-cut aspen trees and limbs on some dams, and freshly-cut aspen stumps on banks along the creek indicated that a relatively small amount of beaver activity still persisted along this section of drainage. Many large beaver ponds were present, and the relative width of the valley and the openness of the

landscape around some of these ponds enabled abundant sunlight to reach the ponds and their northern shorelines. Many local sites (ponds and pools) along the West Fork appeared to offer excellent habitat for boreal toads. Five old (apparently inactive) beaver lodges were observed in the area surveyed along West Fork. The uppermost (southernmost) 100 meters or so of the surveyed area lacked suitable toad habitat, as no ponds were present and the watercourse consisted of a shaded, swiftly-flowing stream beneath a low forest canopy. Brook trout were abundant throughout the West Fork survey area during field surveys in June and August.

Middle Upper – The valley floor was partially covered with very lush willow growth, and its edges were lined with evergreen trees including blue spruce, Engelmann spruce, and subalpine fir. The Middle Fork of Powderhorn Creek (Fig. 4) meandered along the valley floor, connecting a long series of active and inactive beaver ponds. An abundance of felled aspen trees and branches, including both old and recently-cut material, was observed near ponds throughout the survey area. Old stumps and newly-cut stumps (aspen) also were plentiful and widespread in the drainage, indicating the long-term presence of beavers (Exhibit 4). The large number of ponds and pools included many that appeared to offer suitable habitat for boreal toads. Brook trout were abundant all along the surveyed portion of the watercourse.

Middle Lower – Much of the valley floor was covered with dense, shrubby vegetation dominated by willow. Trees present on the valley floor included ponderosa pine, Douglas-fir, aspen, and blue spruce. A long series of active and inactive beaver dams and ponds occurred along the drainage bottom, connected by the stream (Middle Fork of Powderhorn Creek) (Fig. 5). Although many ponds and pools were unsuitable for occupation and breeding by boreal toads because they lacked certain essential habitat features, others appeared to provide favorable conditions for the species. For example, shallow water, emergent vegetation, and gently-sloping bottoms along northern shorelines were unavailable at many ponds but were present at others. No ponds or pools suitable for use by breeding boreal toads were found on the northernmost 450-meter segment of this survey area. Throughout the Middle Lower survey area, brook trout were abundant.

Powderhorn Swamp – Although it is called a “swamp” and it is shown as a marsh on topographic maps, Powderhorn Swamp (Fig. 6) was actually a dry, open grassland with a stream meandering through it during the summer of 2002, due to the effects of sustained drought. The stream flowed northward from the “swamp” into the adjacent forest. The only patch of willows in the swamp was located near the north end, just to the south of the point where the stream entered the forest. Nearly encircling the swamp was a band of treeless ground that was slightly higher and much drier than the swamp, and that was

characterized by abundant, bare, rocky soil and xeric shrubs, forbs, and grasses. (Many of the small rocks in the Powderhorn Swamp area were volcanic in origin.) The aspen forest that covered the slopes surrounding Powderhorn Swamp contained scattered standing live spruce trees (survivors of the fire that had led to the domination of the site by aspens) and numerous standing spruce snags (apparent victims of the fire). No active beaver dams or ponds were present at Powderhorn Swamp. An old, dry, completely silted-in beaver pond and its associated dam were found near the western edge of the swamp, where topographic maps (photorevised in 1982) indicated the presence of a pond.

When the area was first surveyed on June 6, conditions were very dry, and surface water (other than the stream itself) was present only immediately adjacent to a few short stretches of the stream. Only one location in the entire swamp offered suitable habitat for boreal toads. That location consisted of a group of small pools that were located at the site shown on topographic maps as a pond near the north end of the swamp (Exhibit 5). When Powderhorn Swamp was surveyed for boreal toads again on August 21, slightly more water was present throughout the general area, and the group of small pools had expanded and formed a single, large, shallow pool. About half the surface of the pool was covered with floating algae. Brook trout were observed in the stream and in the pool(s) in June and August.

East Fork – In many locations, the valley floor along the East Fork of Powderhorn Creek (Fig. 7) was covered with dense shrub growth, dominated by willow. Among the scattered trees that dotted the valley floor were blue spruce, Engelmann spruce, Douglas-fir, and aspen. A string of active and inactive beaver ponds lay along the bottom of the drainage, connected by the stream. As in many of the other drainages, some dams, ponds, and local sites showed clear evidence of recent beaver activity, whereas others did not (Exhibit 6). The rate of water flow appeared to be higher in August than in June, as was true for all six areas surveyed. Brook trout were abundant in East Fork during June and August.

DISCUSSION

Boreal toads typically breed in slowly-moving or still water, especially in the warm shallows along shorelines with gently-sloping bottoms. Northern shorelines often are chosen for oviposition because of the abundance of sunlight that reaches such sites, hastening anuran development by warming the water and eggs. All segments of drainages that we surveyed for boreal toads were oriented roughly along a north-south axis. Four survey areas were oriented slightly northeast-southwest, whereas the lower section of the Middle Fork and the Powderhorn Swamp area were oriented slightly northwest-southeast. The excessive water depth and the lack of emergent vegetation along the northern shorelines of many ponds

on the boreal toad study area were due to the presence of (sometimes old) beaver dams. The northerly flow of the watercourses on the study area produced water impoundments on the southern sides of beaver dams. Siltation dynamics in these ponds and pools seldom produced shallow, gently sloping bottoms along northern shorelines. Although breeding activities by boreal toads often occur along the northern margins of ponds and pools, they are not limited to such sites. Burger and Bragg (1947) found that boreal toads in northern Gunnison County (near the town of Gothic) bred under a wide range of conditions and they concluded that boreal toads would breed in any body of water that had gently-sloping banks anywhere along its edge, and water that lacked a strong current.

Locations and characteristics of ponds and pools along streams such as Indian Creek and the West, Middle, and East forks of Powderhorn Creek are subject to dramatic change in response to seasonal and other (short-term and long-term) fluctuations in stream flow rate, local water table levels, and other physical, biological, and climatic variables. As a consequence, the suitability of local areas for occupation by boreal toads also is spatially and temporally dynamic. For example, the current regional drought, which is now 2 to 3 years in duration (Western Regional Climate Center 2003*a, b*) has substantially reduced stream flow rates and altered local site conditions along watercourses. Under changing environmental conditions, if sufficiently large areas are available, boreal toad populations can survive by colonizing new sites as conditions become less favorable for them in their current habitat due to hydrological changes, disturbance, the effects of ecological succession, or other factors. Unfortunately, the occurrence of drought generally reduces the amount of wetland habitat available to boreal toads and other wildlife.

Known predators of boreal toads (especially larvae and toadlets) include a variety of birds, as well as western terrestrial garter snakes (*Thamnophis elegans*) and larval tiger salamanders (*Ambystoma tigrinum*). Although several known avian predators of boreal toads (American Robin, Gray Jay, Steller's Jay) were observed during the surveys, no amphibians or snakes were seen on the study area. One eastern fence lizard (*Sceloporus undulatus*) (a terrestrial predator of small arthropods) was observed on an old pile of logs about 0.4 mile upslope from the West Fork of Powderhorn Creek, and a small western terrestrial garter snake was seen on a dirt road about 1 mile to the east of Cap Mountain and about 0.6 mile south of Colorado Highway 149. Although brook trout were present in all areas surveyed except Indian Creek, it is unlikely that their presence excluded boreal toads from these wetlands. Larval toads (genus *Bufo*) often are unpalatable to predatory fish (e.g., Kats et al. 1988). Available information is very limited, but unpublished observations suggest that trout are not important predators of boreal toad larvae in Colorado (see Hammerson 1999:93). Adult toads typically produce foul-tasting, mildly toxic, skin

secretions (especially in the parotoid glands on the back of the head) that may protect them against predation by at least some types of predators. Toadlets and small adult toads may receive protection against predation by brook trout from such secretions.

Although we found no evidence of the presence of boreal toads during field surveys conducted during June and August 2002, we cannot conclude with certainty that boreal toads were not present on the study area. *Bufo boreas boreas* is known to occur in Gunnison County (4 known breeding localities in the Elk Mountains, the West Elk Mountains, and the Sawatch Range), in Hinsdale County (1 known breeding locality in the San Juan Mountains), and in nearby Mineral County (3 known breeding localities in the San Juan Mountains) (Livo and Loeffler 2003). Boreal toads are difficult to detect even under the best field conditions, and conditions were less than ideal during much of the survey period in August due to the prevalence of cool, rainy weather. August surveys at Powderhorn Swamp, the East Fork, and the upper and lower Middle Fork were conducted on relatively cool days during which intermittent rain showers (hail in one instance) alternated with periods of rain-free but overcast or partly cloudy skies. If boreal toads were present, such weather conditions would have substantially reduced their activity and detectability. Another factor that influences the detectability of boreal toads is the fact that individual females visit breeding aggregations only once every two years (Carey 1976). Since surveys for boreal toads do not rely on calls of breeding males but instead are based on observations of (1) adult toads congregated for breeding and (2) the offspring of those adults (i.e., eggs and larvae), the detectability of boreal toads may be reduced by the absence from breeding sites of perhaps half of the adult females in the local area (and their eggs and larvae) during any given year. The influence of this aspect of females' reproductive behavior and biology on the detectability of boreal toads during field surveys would be most pronounced in areas occupied by toads at low densities.

We conclude that boreal toads probably were not present on the study area during the summer of 2002. We cannot be certain that toads were not present, however, because failure to detect the presence of a species does not (except in very rare cases) prove that the species was not present. In addition, *Bufo boreas boreas* is difficult to detect, especially under the weather conditions that prevailed during much of the survey period. Nevertheless, the intensity, comprehensiveness, and thoroughness of our searches along all of the watercourses on the study area strongly suggest that if boreal toads had been present, they would have been detected during the surveys.

Acknowledgments – We are grateful to Dave Kinateder and Sally Thode of the BLM for logistical and technical assistance. We thank Jeremy Siemers for reviewing an earlier version of this manuscript.

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Fig. 1 - 2002 CNHP Boreal Toad Survey Effort in the Powderhorn Wilderness

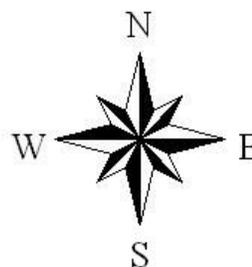
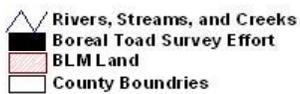
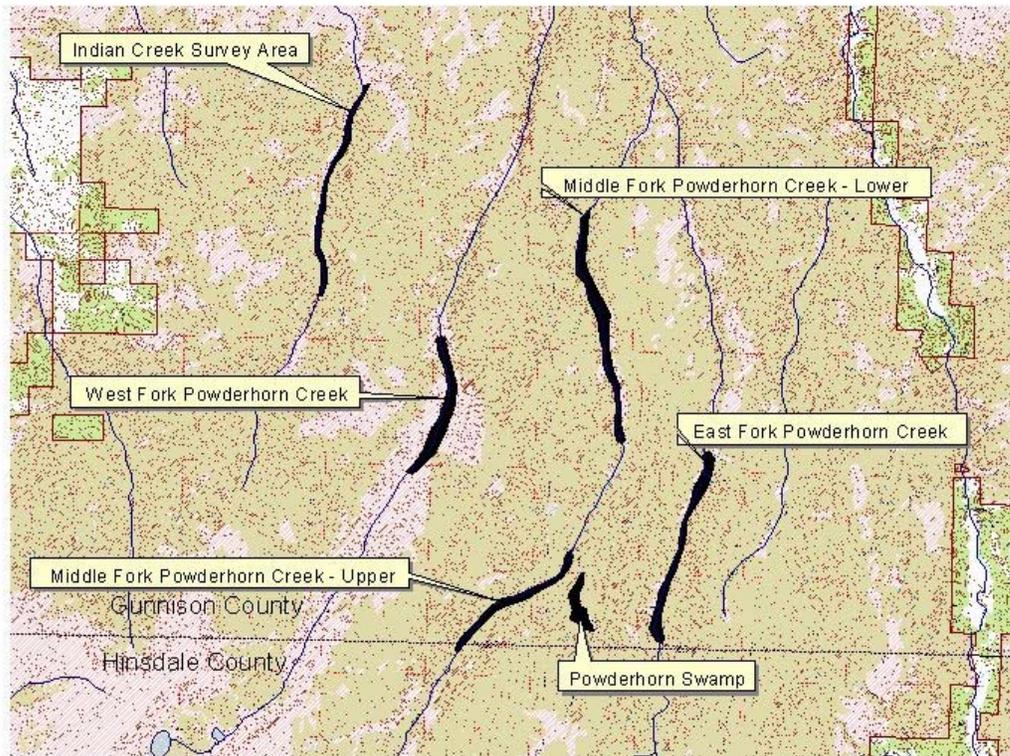


Fig. 2 - Indian Creek Survey Area
Quad Map: Powderhorn Lakes

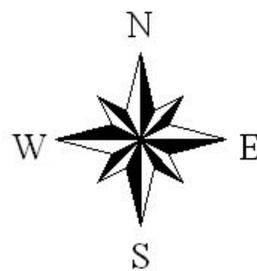
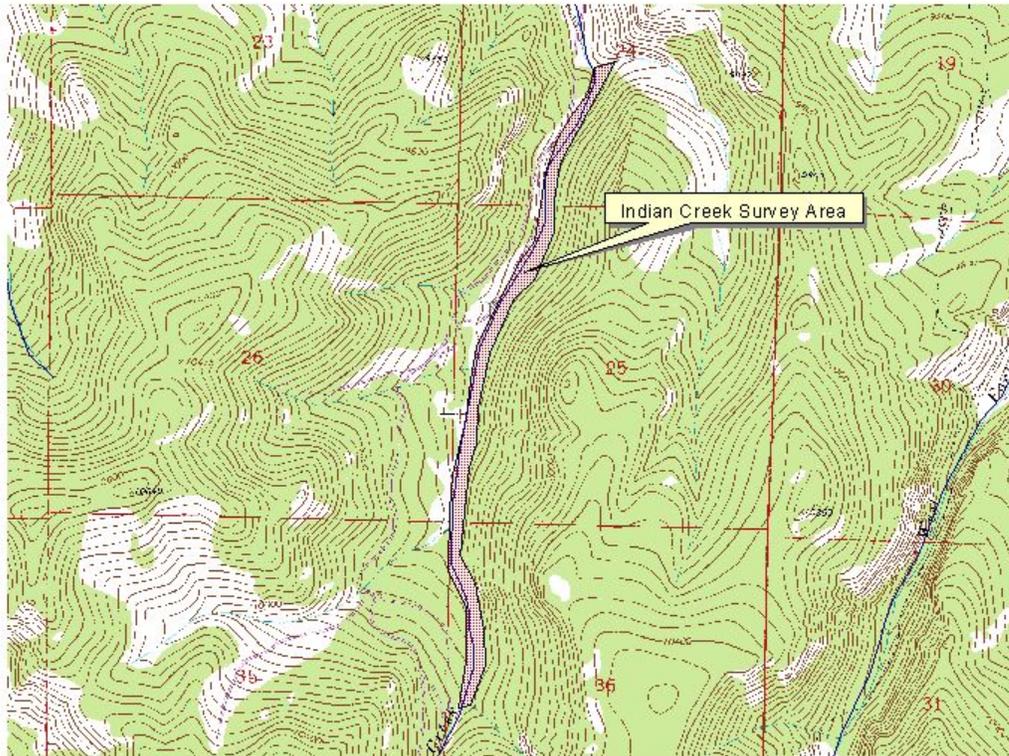


Fig. 3 - West Fork Powderhorn Creek Survey Area
Quad Map: Powderhorn Lakes

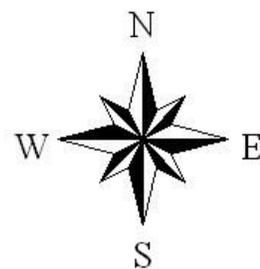
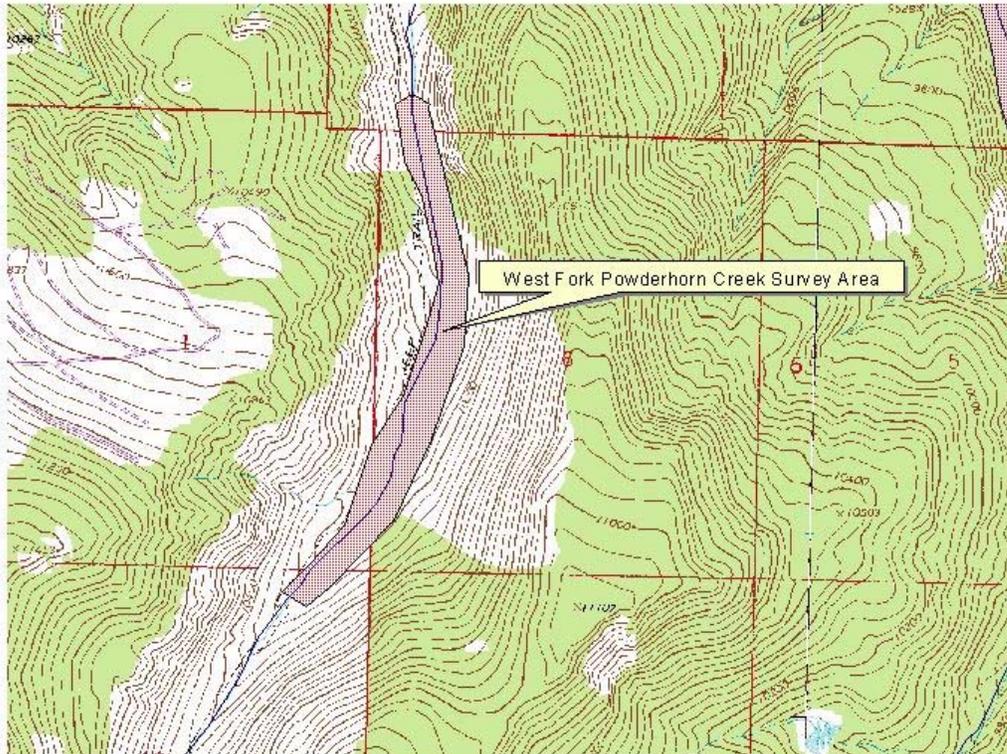


Fig. 4 - Middle Fork Powderhorn Creek - Upper Survey Site
Quad Map: Rudolph Hill, Powderhorn Lakes

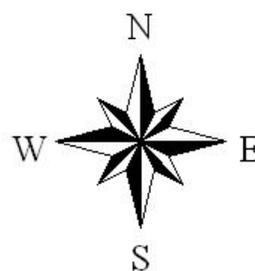
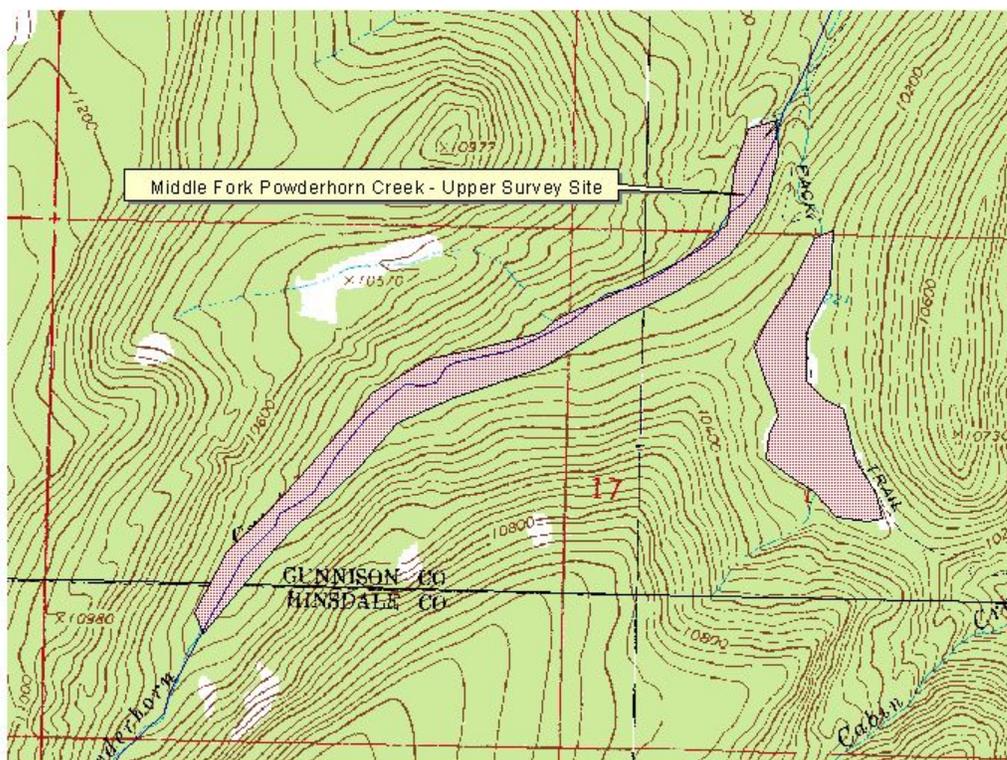


Fig. 5 - Middle Fork Powderhorn Creek - Lower Survey Site
Quad Map: Rudolph Hill

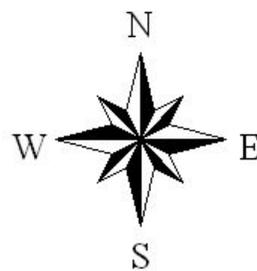
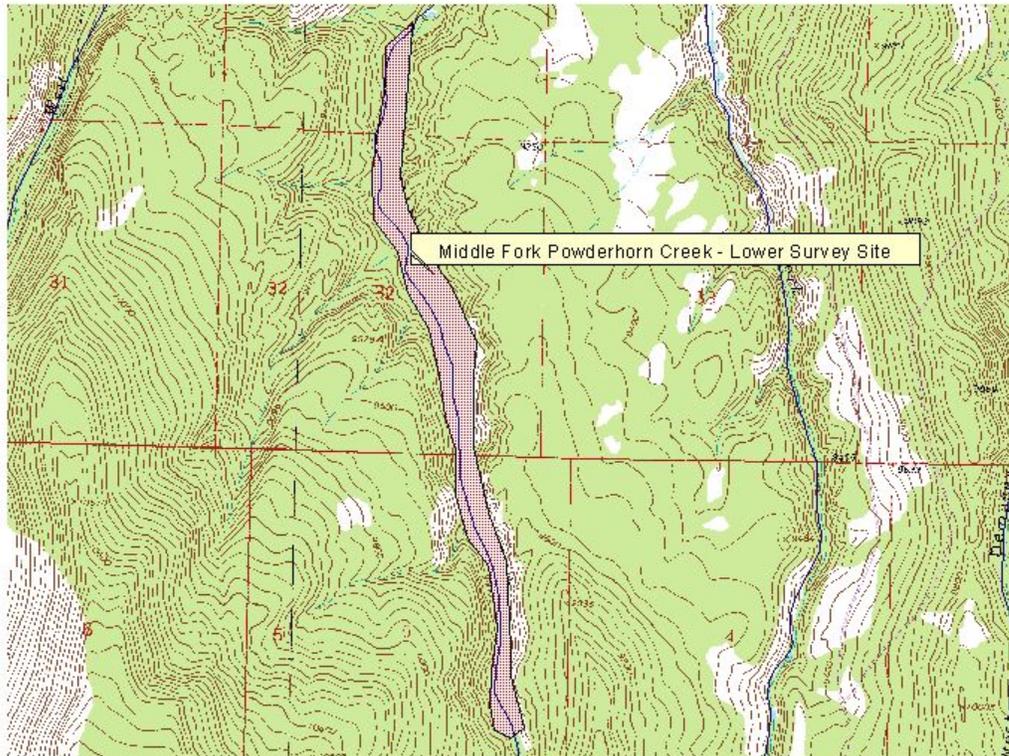


Fig. 6 - Powderhorn Swamp Survey Area
Quad Map: Rudolph Hill

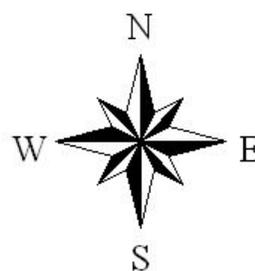
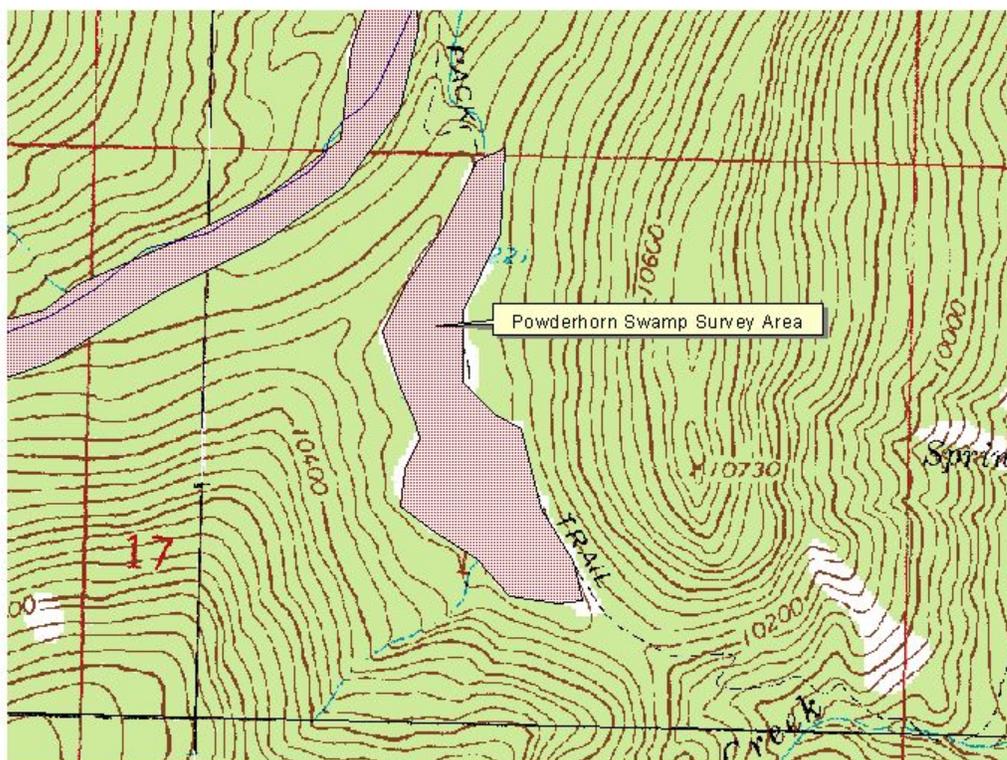


Fig. 7 - East Fork Powderhorn Creek Survey Area
Quad Map: Rudolph Hill

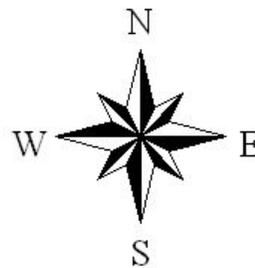
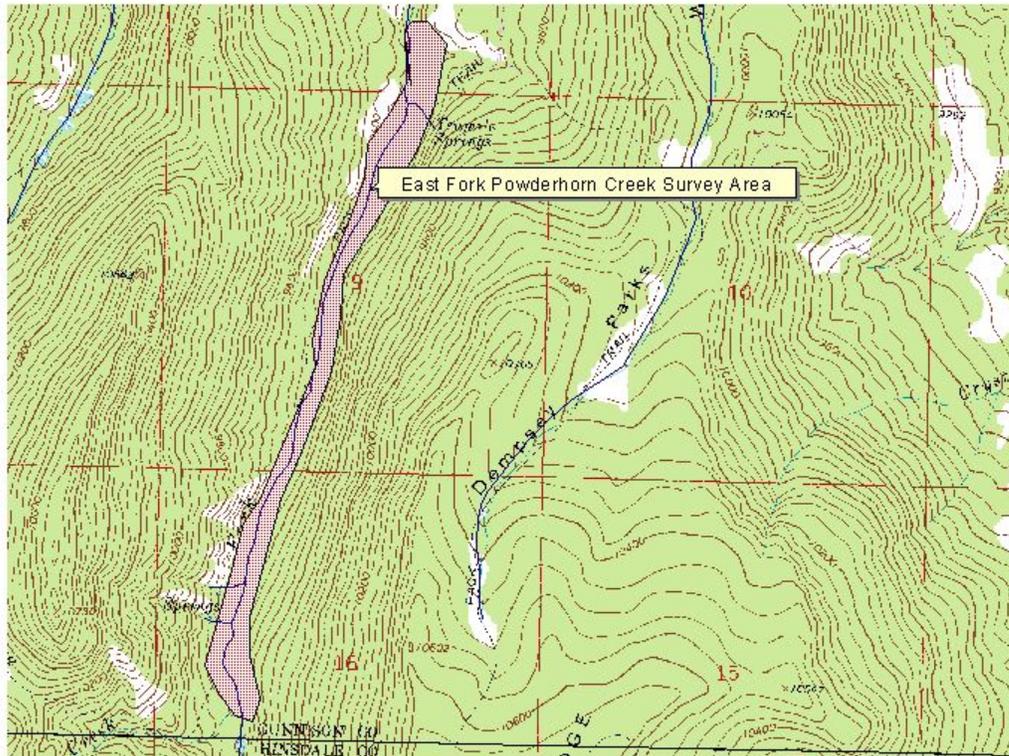




Exhibit 1. Many local sites within the study area provided habitat that appeared to be suitable for use by breeding boreal toads.



Exhibit 2. Dense vegetation along the southern (upstream) portion of Indian Creek was dominated by willow shrubs (*Salix* sp.) and spruce trees (*Picea* spp.).



Exhibit 3. These beaver ponds along the West Fork of Powderhorn Creek were similar to those located throughout much of the study area.



Exhibit 4. Freshly-cut aspen stumps on the bank in the foreground indicate recent activity by beavers along the upper Middle Fork of Powderhorn Creek.



Exhibit 5. One of a few small pools along the stream flowing through Powderhorn Swamp. These pools and the stream provided the only surface water available at Powderhorn Swamp when the area was surveyed for boreal toads during June and August 2002.



Exhibit 6. Long-unattended beaver dams continue to impound water and create pond habitats on the study area.