

DRAFT 5

Abundance and Distribution of *Bromus tectorum* (cheatgrass) along Horse Trail & Peek-A-Boo Loop trail: with notes about treatments completed and proposed.

By J. Muller, Bryce Canyon Biological Technician – Summer, 2001

Introduction:

Cheatgrass, *Bromus tectorum*, was first noted along horse trail in late June, 2000, by Bryce Canyon Interpreter, Brien Park. The vegetation crew immediately began survey and control efforts with assistance from the fence crew and rangers. Due to the late season start, the seeds were mature, so the plants were pulled and bagged to reduce future seed source. Not all the cheatgrass could be treated before seeds were dropped. Control of *Bromus tectorum* (abbreviated as BRTE on site names) along the horse trail was continued in late May, June and early July 2001, using a Stihl weed-eater when the plants were blooming, and pulling & bagging mature plants. Three "new" sites were documented in 2001 along the horse connecting trail. Manual control efforts on these new sites were begun in late June and early July 2001. Still, due to staff shortage, not all the seeds were collected. Most cheatgrass populations were located by hiking the washes and trails surveying for exotic species, a few sites were reported by other park staff.

Cheatgrass (*Bromus tectorum*) is a non-native annual grass found throughout most of the United States, Canada and northern Mexico. An adaptive species from SW Asia with a wide ecological tolerance, it occurs from deserts with 6" annual precipitation, to the southern Great Basin, up into the coniferous forest zone of the Rocky Mountains (Hull, and Peshanec 1947). Cheatgrass is a major species in the sagebrush steppe and Pacific bunchgrass region where it is dominant on more than 100 million acres (Whisenant 1990). Cheatgrass can significantly alter native plant community composition by excluding native species from reproducing (Mosley, Bunting, and Manoukian, 1999). Plant communities dominated by cheatgrass are much more susceptible to frequent wildfires.

Cheatgrass is usually a shallow-rooted winter annual; each year new plants sprout from seeds and the existing seed-producing plants die. Seeds germinate quickly and at high rates (up to 95%), typically in the early fall and overwinter as seedlings. Plants resume growth in early spring and can range from 2 inches to 2 feet tall, depending on water availability and plant density. *Bromus tectorum* has very hairy leaf blades and sheaths, hence some other common names: downy brome, downy chess, downy cheat, and six-weeks grass. It also has open drooping panicles with long straight awns on the seeds. Cheatgrass is easy to confuse with two other bromes. One is an exotic, Japanese brome, *Bromus japonicus*. *Bromus tectorum* is especially easily confused with smaller specimens of nodding brome, *Bromus anomalus*, a regional native.

On much of the horse trail, the top 2-3 inches of soil is ground to a fine, dusty powder by the horses. Ninety to 120 equines (horses, mules) travel the horse trail each day when tour business is steady (most animals make 2 trips daily). Park maintenance's trail cat had recently graded much of the horse trail, starting at from the rim at Sunrise. The goal was to even out the trail, pulling material from the sides to fill in the shallower ruts (1/2 – 2 ft deep). When ruts get deep, the horses/mules are not comfortable walking in them and will tend to walk in new locations. The blade of the cat can clear a swath up to 7 1/2 ft, and the smoothed trail floor is 6.2 to 6.5 ft wide in most places.

I spoke with Leo Chynoweth and one Bryce Canyon Trail Rides employee doing trail work in early June. The trail was to be smoothed with the cat. As there were very few water controls in the past, the concession employees or hired men were installing water bars and other erosion control measures. They said this was the first serious trail work done in 4 years and the currently used, main horse trail is only about 15 years old. Other sections of the trail date from the late 1920's, but what only some of the routes people on horseback used in the past are known.

Methods:

On June 19th, 2001, the Bryce Canyon Horse trail, horse-connecting trail and Peek-A-Boo loop, were measured with a measuring wheel. Measurements were recorded by Jeanette Muller in foot increments. Notations linked to measurements were made of *Bromus tectorum* (BRTE, or cheatgrass) infestations. I described BRTE site locations relative to landmarks and total trail length along the survey routes, off-trail tracks, trails, and other significant features. I also, searched off-trail for cheatgrass locations, horse/mule tracks and droppings.

The purpose of the survey was to precisely map BRTE site locations for future resource managers and begin documenting current trail conditions, social trailing and other impacts. This has been difficult in the past because no accurate maps of the horse trail have existed.

The survey began at the point the horse trail leaves the rim just north of Sunrise Point, east of the day-corral. The survey followed this main trail down to Bryce Creek where it meets the Tropic trail. I turned west and continued. See Figure 1 for the route. The Peek-A-Boo loop was measured starting at the east fork of the trail and following it clockwise around and back to the start at the north side. After measuring the Peek-A-Boo loop, I took the fork to the horse-connecting trail. I passed a falling-down wooden corral and started up the large, sweeping switchbacks that climb the ridge shared with part of the Queen's Garden trail. At the junction of the Queen's Garden and horse trails, I measured the distance of the east-west link trail between Queen's/horse-connecting trail area and the main horse trail and documented the BRTE site found there. I returned to the Queen's/horse-connecting trail junction and measured from there to the rim at Sunrise Point via Queen's Garden trail.

Results:

Every horse trail cheatgrass site I've documented has had horse/mule droppings associated with it, (see Figure 2). The dung has been either excreted at the locations by mules/horses or washed off the trail. The upper BRTE site (BRTE-017-BC) begins 15 or 20 feet from rim in the first large bush. It extends on and off in clumps to a small pine at 122 ft and the drainage below the tree. Much of this site is steep, with ~35- 50% scree slopes. Part of the weeding I did on foot. For part I wore a climbing harness and worked on belay, especially, around the pine tree and the drainage below it. A few other BRTE sites along the route are also hazardous to work.

The distance is 1,289ft from the rim to BRTE-016-BC, a 28x 28ft gently sloping site under ponderosa pines in gravelly soil along the trail. No cheatgrass is observed for the next ~ 1/3 mile. 2,040 ft from the rim to "window rock pass", a hoodoo wall outcrop on the left (east) side just before trail goes down the next hill. The horse trail is about 7 feet wide in narrower spots in this area.

BRTE-011a-BC starts at 2,992 ft, a banked 90 degree corner where cheatgrass starts on both sides of the trail. A fair-sized ponderosa and a medium-sized, thick juniper growing side by side are just off the trail on the east (downhill side). This is a good place to cache water or equipment. From this corner a medium-sized wash trends east for perhaps, a 1/4 mile, I observed with scattered cheatgrass and some horse sign: tracks, hair, dung. I had previously hiked down this wash for ~1/2 mile, stopping at a 6 ft pour-off as a landmark.

The BRTE-011a-BC site continues in varying plant density and width for 533 ft and stops at 3,525 for a short distance. At 3,525 ft, the horse wranglers made a shortcut off the inside of the trail, down a little wash to a flat spot (next to the main trail) full of cheatgrass. 3,580 is the top of the ridge and the uphill end of the "Seal Castle" talk spot for the wranglers and the approximate top of a steep cut-off ~50 steps long. (Note: this may not be the "real" Seal Castle as depicted on the map.) The *Bromus* starts again at 3,849 with a few plants on the east (left) side. Just below these plants about 20 ft or at 3,869 ft is the bottom of the previously mentioned cut-off. This short-cut has horse/mule prints.

3,939 ft. is a thin rock lens on the west side with scattered, small cheatgrass on both sides of the trail (a continuation of BRTE-011a-BC), but is thicker on the west (right). At 3,986 ft landmarks are a rock pile and large log on the west side of the trail. 4,030 ft has BRTE thicker on the east side in ARPU and on the downhill slope and fewer on west side.

4,180 ft is the junction with the short east/west trail connecting the main horse trail with the Queen's Garden and horse connecting trail. The trail is about 6 ft wide in this area. *Bromus tectorum* is not seen here. However, there is BRTE on the north side of the trail up the hill, toward the Queen's Garden at 137ft to 204 ft from junction (BRTE-011b-BC).

4,290 ft is the first steep grade corner. The trail grade is at present too steep, a bigger switchback to lessen slope. The horses are taking the inside steeper path. No BRTE is found here. There is a wash crossing at ~4,350 ft. Note: the trail cat has worked from Sunrise to this area and continued back up and over to the link with the connecting trail. 4,467 ft is the top of a well-defined & stable switchback. This is the end of trail cat work from the Sunrise end.

4,520 cheatgrass starts again (BRTE-011c-BP) mostly on the west side in gravelly soil in sparse vegetation with BRAN (nodding brome), *Poa* sp., *POFR*, *AQSC*. At 4,570ft the cheatgrass lessens. 4,703 trail only 4 ½ to 5 ft wide here. 4,884 edge of wash, here the floor of the trail is an 8' rock-outcrop. This is between a boulder on west and the large hoodoo (with an overhang above the wash) on the east side. The cheatgrass starts in the wash that parallels the east side of the trail here. 4,921 BRTE resumes in varying thickness is 1 to 5 ft wide on both sides of trail.

BRTE-011c-BC continues to 5,135 ft, becomes scarce along trail, perhaps only one plant every 5-10 feet. Into switchbacks here, see small, delicate triple arch/window in big hoodoo on right (west) side of trail. In this area the cheatgrass is scattered in the wash, even in the steep places. 5,217 the trail cat has reached this location from the bottom. From this location, one can see the connecting trail on the ridge to the west. Still very little or no Cheatgrass.

At 5,365 ft the trail is dug into east (left) slope, BRTE has been scraped here. Trail 5 to 5.5ft wide. Cheatgrass here, on west slope below trail and in wash. Note: the wash is now on the right (west) side of the trail. 5,458 ft trail meets wash again, (a small wash also joins from the west here too). See the large boulders on the east side. Below here, the wash is on the left (east) side of the trail again.

Note that this (~5,468 ft) is also one of the spots where off-trail riders rejoin the trail after walking in the wash from (6,293 ft is one access) locations downhill. Also, from this trail/wash crossing down the valley, the cheatgrass is only in the wash and not along the trail for a long distance. 5,485 is the other side of the wash.

6,293 ft is where a log-braced social trail drops off the 5' high stream bank and into the wash from a parallel social path only 7 feet (at the closest) from the main trail. This social path (in and out of the wash) includes: old droppings, old tracks, and fresh tracks and very fresh droppings (that are dry outside, but still moist inside when broken with a stick). I smoothed over the tracks and social trail for a short distance to make a track-trap. Future tracks will be noted. The social trail in the wash is well defined, to the point of having worn bare areas in the brush at several places.

The parallel trail (out of the wash, east of 6,293) continues. 6,428 is a trail cat parking or turn-around spot. Horse/mule tracks are rare below here in the wash, but the parallel trail continues. 6,491 general off-trail trampling on both sides: 31 ft from the east side of trail and 15 ft from west side. At 6,677 another freshly tracked social trail meets the main and goes off.

6816 still observing parallel social trails. 6,943 the main trail turns south and moves further from the wash. I returned to the wash here and cached the wheel and my pack at about 10:05 am to hike the wash. The wash deepens (4 ½ to 5 ½ ft) here for a short distance. Cheatgrass becomes rare, mule/horse tracks are old and not as common after a 1/5 mile. Continue hiking down wash east toward boundary.

I reached the boundary fence at 10:45 am. Check fence, looks OK although has only two strands of wire in wash, cows might be able to push up wire from below and get under. Fence seems OK immediately to the north also, but I did not scout far in the thick brush. I located a USGS marker at the top of bank just west of the fence. Part of it read "Sect. 1, Elev. 6.64". The wash is 6.2 to 6.5 ft deep here.

Cedar gnats were bad from late May through most of June. Left fence at 10:55 am, hiked back up drainage. I found a collapsed small wooden shed with screens on windows (outhouse or chicken coop?) 5 minutes south of the North and South tending main trail, in a connected drainage that contacts the trail a few minutes west of the original one. I returned to where I'd cached the wheel and my pack at 11:35 am. Side hike was an additional 3 mile round-trip.

Continued surveying, 7127: trail crosses wash with a big standing snag and a cut log placed in streambed to control flow. 7360: trail forks: right fork comes from the connecting trail, I took the left branch (toward Tropic and Peak-a-Boo trails). 7,689: crossing with Tropic trail. Turn right (west) toward the rim.

Mules, horses and erosion have worn the trail 4' deeper than surrounding land in this portion (where the horse trail meets the trails leading toward the boundary/Tropic and the Peak-a Boo access). What was the condition of the land and trail area when the horse trail was started approximately 15 years ago?

8,485 ft: Tropic trail crossing with horse and Peak-a-Boo/Navajo links. 8,918: is the crossing with Peak-a-Boo and Navajo links. Peak-a-Boo starts 9,030 ft from rim via horse trail, take the left (east) fork. 9,978 a limber pine with five trunks on left side of trail marks the start of BRTE-014-BP, a small cheatgrass site. 10,022 is the top of BRTE-014-BP site. This is a small shady site under the limber pine and some maple trees. Plants only found along the trail and adjacent drainage. Plants pulled on July 9th, and dug five bull thistle plants from this same location.

11,765 ft is the east tunnel on Peak-a-Boo trail. 11,861 is the top of BRTE-015-BP site, the cheatgrass is on the left (south) side of the trail from here. 12,037 is the bottom of the steep slope between switchbacks (at the main portion of the site). A few plants are on the right side of the trail. The cheatgrass continues down the trail and in the wash in scattered groups.

The trail crosses the wash at 12,199. Bromus stops briefly along trail but continues in adjacent wash. 12,514: see more BRTE along trail and in the wash (below on the left). I marked the site with flagging tied to a small pine tree, and pulled about 20 plants next to the trail on the east (wash) side. Plants are not thick, but dropping seed, so need to return and pull the rest. Plant pulled on July 9th visit.

12,869: large overhang, good shade. 13,670: large wash. 15,722: intersection with Bryce Point connecting trail. ~16,550: reached horse corrals, break area. I observed a wrangler riding up fast from the north (drainage) to prepare for his group. I am pretty certain that he'd been traveling off-trail, especially, since I was near the corral entrance/trail junction talking with hikers and the wrangler did not pass us at either branch of the trail. But, when I asked if he was off trail, he replied, "No, ma'am".

On July 9th, I was following this horse-wrangler social trail from where it leave the main trail (east end of social trail) when I noticed a small overhang/cave along the stream. This small water-carved, (SE facing?) overhang is <100 ft from the main trail and ~40 ft north of the social trail and is visible from both. The overhang contained ~12 wood fence posts and other debris. It's about 3.75 ft tall, half moon-shaped, perhaps 12 ft by 20 ft with a few sets of graffiti carved into rocks set like flagstones on the floor. Because the roof of the cave had black, perhaps charcoal on it, I spoke with Chris Wenkler?, (950) a few days later. I showed him a sketch of one unusual carving. He wondered if it could represent an old livestock brand. We checked a list of current local brands and found no matches.

While I was in the "cave", the afternoon ½ day horse ride was passing, with one wrangler in the lead and one at the end. I could clearly hear the last wrangler tell a rider "We're almost there, that's where I'm heading in just a minute." Just then the last wrangler reached the social trail leading to the corral, he casually directed his mule off the main trail, and made quick trip toward the corral. I followed a few minutes later, this cut-off does get the wrangler to the corral a couple minutes ahead of the tour and allow them to prepare for the riders. The social trail is about 5-6 ft wide where it leaves the trail and 2-3ft wide in most spots. It's up to 12" deep in a place where it parallels the drainage. There was a moderate amount of dung, and tracks the length of the social trail. That and the casual attitude of the wranglers taking the shortcuts makes me think short-cutting is a daily affair.

16,606 ft: side trail to the toilets. 17,158: good trickle of water on west (left) side. 18,179: slow trickle of water originating from the west side. 19,461: pulled one 3' tall alfalfa plant growing on a 30% slope between trail switchbacks near the top of hill. 19,544: middle of west Peak-a-Boo tunnel. 20,743: social trail and trail sign "DANGEROUS CLIFFS- STAY ON WALKS". 21,610: trail passes through a deep cut in hoodoo. 24,848: end of Peak-a-Boo trail, total length of loop = 15,818 ft.

25,389 ft: back to Tropic/ Horse trail junctions, stay left go on horse trail toward connecting trail to Queen's Garden. 26,369: side trail to west and old broken down corrals. ~26,578 ft: huge juniper tree in wash just before starting up switchbacks of connecting trail. Research of the park administrative history dates this section of trail to 1929.

27,303: BRTE-023-BP cheatgrass site on 2nd switchback, about a 1/8 mile from bottom. Look for a 5' tall dead snag on south side of trail and a large 10' exposed root on north slope a few feet above trail. Put a small flag on root. 27,370 ft: large hoodoo at corner.

27,506: bottom of BRTE-024-BP ('triple hoodoo site'). 27,540 ft: part of site scraped by trail cat top of switchbacks. 27,591: upper end of site. Parts of the lower horse trail, Tropic trail and Peak-a-Boo can be seen from here and the previous site (BRTE-023-BP).

27,673: ponderosa pine just beyond the south end of "killer site", BRTE-025-BP. This breaks site is on 35 – 50% slopes covered with clay, gravel and scree. Footing is very precarious on most of the slope, fire boots recommended. Cheatgrass extends nearly 50 ft along the trail and down the east slope up to ~ 40 ft, but is thickest at top 10 ft. There is some Bromus on the other side of the trail, but only thin groups and small individuals, since the soil is thin and gravelly. 27,724 ft: north end of the "killer site", large hoodoo next to trail on east side.

From this site and the trail, much of the parallel social trails and main trail (~5,217 down to ~6,800 ft) the areas can be seen about 150 ft below. When I was pulling cheatgrass at BRTE-025-BC, June 8, 2001, I observed a rider (wrangler?) using the social trails to pass some other riders on one of the afternoon rides. They would have been between the 6,650ft to the 5,500ft area. I tried to get a couple photographs with the digital camera but the distance and trees blocking the view will make for poor photos.

28,530: trail cat pull-out parking near top of ridge on west side of trail. 28,763: south end of BRTE-026-BC site. 28,799: north end of site. This site is on the east slope of the trail, at the top of a break (bare slope of ~30% grade). 29,112: intersection with the Queen's Garden, Horse and horse-connecting trail, only 313 ft from north end of the site. BRTE-026-BC is only 3,095 ft from the rim via Queen's Garden/Sunrise trail, the closest access.

At Bryce Canyon, the largest, most dense populations of *Bromus tectorum*, are found associated with the horse/mule day corrals, horse trails, and along roadsides. Cheatgrass, has not been found on any other trails in the park except one area along the rim trail toward Fairyland. Most cheatgrass populations were located by hiking trails surveying for exotic species.

National Park Service policy is to preserve or restore landscapes in as natural as possible state. To do this, non-native plants must be controlled or they will take over the land. Control of exotic plants can be done in several ways. The strategies for cheatgrass removal at Bryce Canyon are:, 1) using a weed-eater to mechanically cut the

young plants before mature, 2) treating young cheatgrass with chemical herbicides before seeds are viable, 3) or pulling and bagging mature plants to prevent seed dispersal.

Due to the late June control start, in 2000, the cheatgrass seeds were mature, so the plants were pulled and bagged to reduce future seed source. Over 100 total hours of labor were spent along the main horse trail in 2000, the majority of which, 95 hours, being spent pulling and bagging cheatgrass. On the main trail section, each crew-member filled (packed down) a medium-sized garbage bag of pulled cheatgrass each full work day, during the several days we worked there. Plants were too numerous to count.

Recommendations:

Seeds can spread by short distances by wind. Animals (wild and domestic) carry cheatgrass in their feces, hooves, hair, and tails. Cropland intermingled with rangeland is another seed source, particularly fields of winter wheat and dryland hay. Humans can transport cheatgrass seeds in vehicles and clothing. (Mosley, Bunting, and Manoukian, 1999). Although most cheatgrass seeds do not survive longer than one year on rangelands (Hulbert 1995), the seeds may remain viable for several years when stored dry within bales of hay or straw. Subsequently transporting and feeding these bales to livestock in un-infested areas can spread cheatgrass.

Management suggestions include:

1. Presenting a resource orientation to the wranglers regarding the importance of staying on trail and reducing BRTE populations. In two years at Bryce during my relatively brief visits on the horse trail, I had observed wranglers off trail 5 times: twice in 2000, 3 times in 2001. Some of these were after the park reminded the concessioner that horses are to remain on the trail. Are the park's rules not being passed on to the wranglers leading rides or were they being ignored? Since June the trail rule was again brought up in a meeting with Bryce Canyon Trail Rides owner, Pete Mangum.
2. Encouraging the weed-free hay certification to include cheatgrass, and other non-natives before horse/mule feed is brought in to Bryce Canyon.
3. GPSing the entire route of the trail and locations of *Bromus tectorum* populations will insure greater accuracy with our maps.
4. I also, ask other park staff to hike the horse trail to contact hikers and riders using the trail. During my work on the horse trail, I contact a surprising number of hikers. Some of them are lost and needing directions, other hikers are just exploring an under-hiked area, many visitors asked questions and appreciated having an employee provide interpretation.