Use of Diminished Whitebark Pine Resources by Adult Female Grizzly Bears in Togwotee Pass, Spread Creek, and Mount Leidy in the Bridger-Teton National Forest, Wyoming, 2012 *(Kyle Orozco and Nick Miles, Interagency Grizzly Bear Study Team)*

The importance of whitebark pine as a food source for Yellowstone grizzly bears is well documented (Kendall 1983, Mattson et al. 1991*a*, Mattson et al. 1992, Felicetti et al. 2003, Schwartz et al. 2006*c*). The Yellowstone population was delisted from the federal Threatened Species List in 2007, but that decision was overturned by a district court judge in 2009 partially on the grounds that the USFWS had not adequately addressed potential future impacts to bears by changes in whitebark pine availability resulting from rapid, widespread whitebark pine mortality that began in the early 2000s.

Several recent evaluations document the decline of whitebark pine in the GYE. Interpretation of 2007 satellite imagery by the U.S. Department of Agriculture (USDA) Remote Sensing Applications Center indicated over 40% of whitebark pine stands in the GYE contained some level of canopy mortality (Goetz et al. 2009). Aerial surveys by the USDA Forest Health Protection program found beetle activity in more than 50% of whitebark pine stands in the GYE in 2008. Aerial photo evaluation at a sub-watershed level documented the spatial extent and severity of whitebark pine damage from mountain pine beetle outbreaks across the entire GYE (Macfarlane et al. 2010). Data from that project indicates that over 50% of whitebark pine stands in the GYE have suffered high to complete mortality of overstory trees and 95% of forest stands containing whitebark pine have measurable mountain pine beetle activity (Macfarlane et al. 2010). White pine blister rust (*Cronartium ribicola*), a fungus introduced from Eurasia, is widespread and continuing to increase in incidence and severity; GYE-wide infection rates range from 20 to 81% (Bockino 2008, Bockino and McCloskey 2010, GYWPMWG 2010, Jean et al. 2011). In the northern Rocky Mountains, mortality is as high as 90% (Gibson et al. 2008) and the Interior Columbia Basin whitebark pine populations have declined by at least 45% (Kendall and Keane 2001).

Previous studies provide some perspective on the degree to which grizzly bears in the GYE use whitebark pine seeds. During 1977–1987, scats from bears in the population centered on YNP consisted of 39% whitebark pine seeds on average for the month of September (typically the peak of whitebark pine feeding activity, Mattson et al. 1991*a*). The 1977–1987 period represented the typical range of cone production. Female grizzly bears captured in GTNP in 2004–2006 had <10% digestibility-corrected volume of whitebark pine in their scats (IGBST, unpublished data). Volume of whitebark pine in scats from male grizzly bears was >40%. Mountain pine beetle impacts in that area were light to moderate.

In the fall of 2012, we conducted a study to examine how grizzly bears are currently using whitebark pine in an area of the GYE that had been heavily impacted by mountain pine beetles (Fig. 17). We deployed 3 downloadable GPS collars on adult female grizzly bears. We documented habitat use by on-site examinations of those bear locations, and food habits through analysis of fecal samples collected at visited sites during autumn.

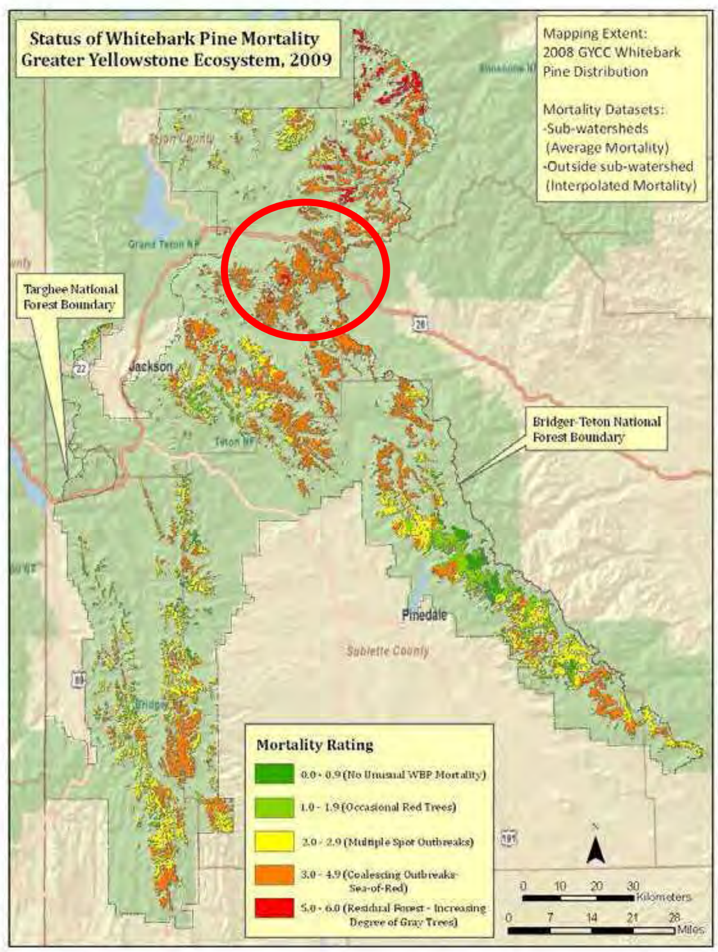

Fig. 17. Map showing status of whitebark pine mortality in the southeastern portion of the Greater Yellowstone Ecosystem. Togwotee Pass, Mount Leidy, and Spread Creek areas circled (From Macfarlane et al. 2010).

Methods

Once a week, we remotely downloaded location data from transmitters via fixed-wing aircraft. We conducted site visits of GPS telemetry locations to determine habitat selection and foraging patterns. Each week, we randomly selected a day from the week's download of each bear. For each bear-day, we visited most GPS locations collected for that 24-hour period. Our goal was to discern the foraging patterns of each sampled bear over a 24-hour time period.

At each visited location, we performed a detailed search for evidence of bear feeding activity and feces within approximately 20 m of the GPS location. Depending upon the evidence of bear use found, we collected 2 different levels of data to describe bear activity and relevant information about the vegetation on site. For all plots, we collected basic site description information (level 1) and recorded types of feeding activities found. If evidence of feeding was found, we collected more detailed information on species used (level 2). Scats found at each site were collected and frozen.

Laboratory analysis of scat contents followed the procedures of Mealey (1980). Fecal samples were first air-dried then rehydrated and rinsed through coarse (0.125 in^2) and fine (0.0328 in^2) soil sieves. Any loss of small seeds was noted during the rinsing process. Rinsed samples were placed in a white enamel pan with water to disperse items. Individual items were identified to the finest possible taxonomic level, and estimated percent composition of each item recorded. Diet items were grouped into categories following Mattson et al. (1991*a*). Because consumed items vary in digestibility and may be over- or underrepresented in scat volumes, we used the correction factors recommended by Hewitt and Robbins (1996) to estimate percent digestible dry matter for each group of items in the scats.

Results

In spring of 2012, WYGF deployed 3 SST collars on 2 adult and 1 subadult female grizzly bears around Togwotee Pass, Mount Leidy, and Spread Creek, in the Bridger-Teton National Forest. A field crew visited 283 locations of the collars between 4 September and 7 October. The sample represented a combined number of 15 bear-days. One hundred ten (38.9%) sites were located within approximately 20 m of a daybed, with 20 daybeds recorded. One hundred forty-two (50%) sites were within approximately 20 m of a scat, with 41 scats collected. Of the locations visited, 127 (44.9%) sites had evidence of feeding activity (Table 22). Four major feeding activities were identified at these locations:

1. Carcasses – large ungulate carcasses (elk, deer, bison) from predation or scavenging.
2. Roots – primarily licorice root (*Osmorhiza berteroi*) dug directly by bears.
3. Whitebark pine – squirrel middens excavated to obtain cones.
4. Insects – excavations of deadfall logs or anthills for insects.

Table 22. Feeding activities at 283 Global Positioning System locations of 2 female grizzly bears, Bridger-Teton National Forest, September–October 2012.

Feeding activity	As a % of all 283 sites visited	As a % of 127 sites with feeding activity
Ungulates (*n* = 111)	39.2%	87.4%
Roots (*n* = 9)	3.2%	7.8%
Whitebark pine (*n* = 4)	1.4%	3.2%
Insects (*n* = 3)	1.1%	2.4%

Whitebark pine seed feeding was documented at 4 sites, or 3.1% of all feeding activity observed. All of these observations were from the month of September, with the earliest sign of whitebark pine feeding on 4 September. Combined, our 3 collared bears had a total of 111 locations on carcasses, representing 87.4% of all feeding activity. Root feeding was documented at 9 sites, or 7.1% of all feeding activity, and insect feeding was found at 3 sites or 2.4% of feeding activity (Table 22).

Whitebark pine constituted 8.1% of the dry digestible matter in collected scats, but were present in 9.8% of scats. Forbs were the most common item found (63.4%) in scats, however they only a made up 5.6% of dry digestible material. Ungulates occurred in 46.3% of scats and made up 54.2% of dry digestible material. Roots made up the second highest percent of digestible material (9.8%). Other items found in scats include grasses, berries, and insects (Table 23).

Table 23. Food items in 41 scats of 3 female grizzly bears, Bridger-Teton National Forest, September–October 2012. Percent volume of dry digestible material was calculated using procedures and correction factors of Hewitt and Robbins (1996).

Food item	% volume[a]	% occurrence
Roots	9.8%	34.2%
Grasses and sedges	3.8%	61.0%
Forbs	5.6%	63.4%
Berries	0.8%	9.8%
Insects	2.9%	24.4%
Ungulates	54.2%	46.3%
Whitebark pine seeds	8.1%	9.8%

[a] Percent volumes of dry digestible material do not add up to 100% because the amount of dirt and debris found in scats was excluded from calculations.

Discussion

Whitebark pine cone production in 2012 was very good, with an average of 33 cones/live tree on established transects throughout the GYE (Haroldson and Podruzny 2012). The mapping effort in 2009 (Macfarlane et al. 2010) shows that the Bridger-Teton National Forest has experienced high whitebark pine mortality on nearly 100,000 hectares, and categorizes the severity of mortality around Mount Leidy and Togwotee Pass as extreme.

The heavy overstory mortality was evident in our feeding data, with only 4 sites (3.1%) showing evidence of whitebark pine seed feeding. In our forested study plots, between 5 and 10 trees were measured for diameter at breast height (DBH) and recorded for status: either live or dead. On Togwotee Pass, 28 whitebark pine trees were measured. Of these 28 trees, 5 (18%) were alive and 23 (82%) were dead. On Mount Leidy, a total of 75 whitebark pine trees were observed. We observed 11 (15%) live and 64 (85%) dead whitebark pine. Spread Creek had the fewest number of whitebark pine due to that areas low elevation; 7 whitebark pine were observed with only 1 live tree, or a mortality of 86%. Total mortality for all measured whitebark pine in the area for this study was 84.5% (93/110). This is higher than the mortality of 73.2% seen in established plots throughout the GYE since 2002 (Haroldson and Podruzny 2012). The higher rate of mortality in our study area could explain the low use of whitebark pine seeds we observed in our bears. Furthermore, the average DBH for live whitebark pine was 21.8 cm whereas the average DBH for dead whitebark pine was 34.6 cm, confirming data from other studies that beetles targeted and killed larger, more mature trees that produce the most cones.

Over 87% of feeding activity was recorded at carcass sites (Table 22). The 3 bears visited a total of 12 confirmed carcasses during the 15 bear days we visited. The carcasses included 6 hunter-killed elk, 3 mule deer, 1 bison, and 2 domestic horses. The majority of the study area is open for archery hunting in early September and rifle hunting at the end of September/early October, which explains why our bears targeted gut piles and wounding loss during this time. We found that ungulates constituted 54.2% of dry digestible material, whereas whitebark pine only made up 8.1% of dry digestible material (Table 23). Given the low levels of whitebark pine feeding and high frequency of carcass feeding, it seems that hunter-killed elk and deer provided an alternative food source for bears during fall in these areas with high whitebark pine mortality.