



DISCOVERY

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GRIZZLIES AND WHITEBARK PINE: WHAT'S THE CONNECTION?

Whitebark pine is considered by many biologists to be a keystone species of the subalpine community. Photo: Richard Lake

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On a blustery late April afternoon along the northwestern flanks of Mount Washburn in Yellowstone National Park, a raggedy-looking female grizzly meanders through a thick stand of whitebark pine in hopes of ending her five-month-long hunger strike. The nine-year-old sow knows this country well, having traveled these slopes and drainages with her mother for the first two years of her life. Now she calls this area home, and with three cubs of the year following at her heels, it is the place she hopes to find the nutritional sustenance her family will need to survive in this wild and rugged landscape.

The previous fall—mid-October to be exact—she began excavating a tightly constructed den, which she lined with dry grasses and boughs from a neighboring Douglas-fir. Upon the first signs of inclement weather, she slowly squeezed her way into her tomb-like home where she would sleep away Yellowstone's harsh winter season. Though many other grizzlies embraced

this first sign of winter and instead chose to continue raiding the middens of red squirrels, our nine-year-old sow had more important business to attend to.

Sometime during the last week of January she awoke just enough to give birth to three rat-sized cubs with no hair, no teeth, and no ability to open their eyes. The female grizzly bear (a member of the Ursidae family) goes through a unique process called delayed implantation. Though this sow's eggs had been fertilized during the mating season (mid-June through mid-July), the zygotes developed just briefly, to the blastocyst stage. Unlike most other mammals, in which the developing eggs attach to the wall of the uterus and continue to grow, this sow's blastocysts floated around the womb in suspended animation, enabling the female bear

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to conserve energy to meet her own needs—rather than the needs of the developing embryos.

It was not until this bear went into hibernation that her body conducted a self-assessment of whether she was in good enough shape to carry the pregnancy to term. The outcome of this assessment was largely dependent upon how nutritionally productive the fall had been for this female.

In the Yellowstone ecosystem, a bear's fall nutrition and the availability of whitebark pine seeds go hand in hand. In the case of our nine-year-old female, the previous fall's lucrative whitebark pine crop left her in ideal condition going into hibernation and allowed her to emerge now with three cubs in tow.



Its ability to thrive in the face of the region's harshest conditions makes the whitebark pine the soldier of Rocky Mountain tree species. Photo: R.G. Johnson

Omnivore generalists, grizzly bears will eat just about anything that allows them to pack on the calories. In Alaska,

the coastal grizzlies have abundant salmon runs that they depend upon,

but Yellowstone doesn't have the luxury of such fecundity. Like Alaska, however, Yellowstone does offer one staple that is arguably the most important food source for grizzly bears in this ecosystem—the whitebark pine seed.

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The Yellowstone Association, in partnership with the National Park Service, fosters the public's understanding, appreciation and enjoyment of Yellowstone National Park and its surrounding ecosystem by funding and providing educational products and services.

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For everyone who ventures into the subalpine zones of the Rocky Mountains, Cascade, Sierra, and British Columbia coastal ranges, the whitebark pine is a symbol of high-elevation, rugged terrain. Because of its gnarled growth pattern and the difficulty to access it, this long-lived, slow-growing, five-needled pine found throughout the Yellowstone ecosystem at elevations exceeding 8000 feet has relatively little commercial value, but it is considered by many biologists to be a keystone species of the subalpine community.

Its ability to thrive in the face of the region's harshest conditions makes the whitebark pine the soldier of Rocky Mountain tree species. Growing on cold, dry, windy sites with soils inhospitable to other conifers, the whitebark pine pioneers landscapes where no other tree could possibly survive. In addition to its stunning beauty, the whitebark pine is valued for its watershed protection capabilities. Rooted at elevations where the greatest amount of snowfall occurs, the up-swept branches of the crown, coupled with the whitebark pine's ability to flourish on Yellowstone's windiest

slopes, create natural snow fences. Accumulating snow at their bases, whitebark pines prolong the longevity of the snowpack, gradually releasing the water that will feed our mountain streams when they need it most.

Yet, for the grizzly, the whitebark pine provides much more than stunning beauty and watershed protection. Of the numerous food sources that a Yellowstone grizzly bear keys in on each year, there is perhaps no single resource of greater importance than the seeds of the whitebark pine. Late summer and early fall mark a vital time of year in a grizzly bear's life—hyperphagia. This is a period of intensive feeding, when the bear's metabolic activity kicks into high gear—a time to focus on putting on as much weight as possible before entering into hibernation. And with nutritional figures such as 21 percent carbohydrates, 21 percent protein, and 52 percent fat, the oily whitebark pine seed packs more bang for its buck than just about any other food source in the ecosystem available to bears during this critical time.

So critical is the whitebark pine to Yellowstone's grizzlies that, over the years, biologists have found a common thread between the two—and it is not solely related to nutrition.

When abundant seeds are available, bears utilize the high-elevation habitat of the whitebark pine, searching out seeds that have been harvested and cached by red squirrels. Unlike black bears, which will climb a whitebark pine to harvest the cones themselves, grizzlies typically depend upon the squirrel to do their dirty work for them. During bumper crop years, it is not uncommon for bears to feed exclusively upon whitebark pine seeds from late August until the time they go into hibernation. Thus good seed crops limit the movements of grizzlies during a critical period of human presence—hunting season outside the park—keeping bears at elevations that will minimize the potential for human encounters, which often turn deadly for the bears.

Conversely, poor autumn seed crops cause the grizzly bear to roam far and wide in search of high quality food alternatives. Unlike the salmon runs in coastal Alaska and the berry crops



Recent studies show that during years of poor whitebark pine production, Yellowstone's adult male grizzlies tend to dominate the most productive habitat, displacing females and sub-adult bears. Photo: Bridget Lyons

in the Northern Continental Divide Ecosystem (Glacier National Park), that bears grow accustomed to year in and out, the whitebark pine seed production in the Greater Yellowstone Ecosystem (GYE) is unreliable. The grizzlies who call Yellowstone home have learned to adapt during poor whitebark pine crops, often by increasing movement and, in the process, increasing the number of bear-human encounters.

This need for increased movement is especially troubling for females with young. Recent studies show that during years of poor whitebark pine production, Yellowstone's adult male grizzlies tend to dominate the most productive habitat, displacing females and sub-adult bears. Since females drive the grizzly bear population, and the grizzly is one of the slowest reproducing land mammals in North America, these fall wanderings often have troubling consequences.

On average the female grizzly only reproduces every third year, and she doesn't even begin the reproduction process until somewhere between the age of five—when the grizzly is first considered an adult—and the age of nine. Factor in the mortality rates of the grizzly young—the average survival rate of a grizzly cub in Yellowstone National Park bounces from approximately 64 percent its first year to 82 percent its second, before dropping to 52 percent

for the third and fourth years—and one can see how lengthy an endeavor it is for a female to simply reproduce herself. As gloomy as this may seem, research indicates that females who utilize whitebark pine seeds reproduce earlier and have higher reproductive rates than bears that fail to uncover pine seeds—further illustrating the intricate relationship that exists between these two species.

Another example of that common thread: according to preliminary results from a recent University of Idaho study, female grizzly bears utilize whitebark pine seeds in a higher proportion than males. Yellowstone National Park bear biologist Travis Wyman believes that many adult male bears tend to focus on the abundance of meat such as elk and bison which has become more available throughout the park since the return of their primary predator, the wolf.

This appears to suggest that a healthy whitebark pine stand acts as a refuge for females and their cubs at a time of year when they most need security. And yet a productive whitebark pine seed year can stretch well beyond the critical fall feeding frenzy. In years where an explosion of whitebark pine occurs, the fatty seeds will remain a viable food source for bears emerging from their dens in the spring. After several months without eating, and a loss of up to 25

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Jesse Logan, a recently retired U.S. Forest Service research entomologist, believes that the recent outbreaks of mountain pine beetles are connected to climate change. Photo: Unknown

percent of their body weight, a discovery of leftover middens can, for some bears, mean the difference between starvation and another summer season spent roaming the depths of Yellowstone.

By now it seems abundantly clear that the whitebark pine functions in multiple ways to ensure a healthy grizzly population in Yellowstone. One might go so far as to call the whitebark pine a “guardian” for Yellowstone’s grizzlies.

But there is a problem. Whitebark pines are under attack in Yellowstone. The whitebark pine is experiencing an alarmingly rapid decline throughout the West—a decline that, unless reversed, could potentially have a dramatic impact on the Yellowstone grizzly population. The culprits? Blister rust, mountain pine beetles, and climate change.

White pine blister rust, an exotic fungus that crossed the ocean on trees from Europe, was discovered around 1910 in British Columbia. Blister rust spores are decimating whitebark pine trees throughout their historic range here in the West. Though the most devastating effects of blister rust have been felt in moister climates, such as the coastal ranges of British Columbia, Washington, and Oregon, the fungus

can affect any and all whitebark pine trees. According to Katherine Kendall of the National Biological Service, “Fewer than 1 in 10,000 whitebark pine trees are rust-resistant.”

While the entire tri-state region of Wyoming, Idaho, and Montana has been impacted, the effects of blister rust have been greatest in western Montana and northern Idaho. Kendall’s research reveals that in those portions of the Northern Continental Divide Ecosystem that include Glacier National Park and the Bob Marshall Wilderness—which host the only other viable populations of grizzly bears in the lower 48 states—nearly half of the whitebark pine forests are now functionally extinct. And studies suggest that more than 80 percent of the remaining trees are infected with rust. Due to its dry conditions, the GYE has not experienced this degree of devastation to date, but in recent years infection rates have increased, and this rise in die-offs is expected to grow, ensuring that biologists will be keeping a close eye on blister rust in the Yellowstone ecosystem in the years to come.

Rising temperatures throughout the West present yet another serious threat to the long-term viability of whitebark

pine in the GYE. Throughout the tri-state area, locals and visitors alike have seen the tremendous toll the pine beetle has taken on ponderosa and lodgepole pine forests; but now, as the mercury rises, they are witnessing the pine beetle extending its range into the high-elevation whitebark pine forests once thought to be out of reach.

Mountain pine beetles occur naturally in this part of the world, yet this tiny beetle’s impact within the whitebark pine stands in Yellowstone National Park and the surrounding forests has never been greater. Jesse Logan, a recently retired U.S. Forest Service research entomologist, believes that the recent outbreaks of mountain pine beetles are connected to climate change. He makes it clear that the difference between today and the not-so-distant past is that we no longer have the extreme temperatures of minus 40°F for a couple of days each winter to help control the beetles. Instead, above-normal temperatures are allowing the beetle to survive winter and extend its range. In 2004 alone, more than 700,000 whitebark pines in the GYE were killed by beetles. It doesn’t appear this trend will end anytime in the near future. These slow-growing pines don’t even begin to bear cones until somewhere between 50 and 65



We can only hope—for the sake of these cubs and all the other grizzlies roaming the wild lands which abound throughout Yellowstone—that in years to come we will see a return of the precious whitebark pine seed crop to propel them through yet another season. Photo: NPS

years of age; therefore, any attempt to re-establish whitebark pine forests would be a lengthy endeavor at best.

So what does this mean for grizzlies—and users of grizzly bear habitat? The loss of a key fall food source could potentially have major implications for the grizzlies of the GYE.

“The whitebark pine is on its way out,” says Diana Tomback, head of the Whitebark Pine Ecosystem Foundation and professor of biology at the University of Colorado. “Whitebark is not going to make it without management intervention.” While not all biologists and ornithologists speak as bluntly about the future of whitebark pine as Tomback, there is a consensus in the forest management community that the future of the whitebark pine looks bleak.

Throughout the course of the debate regarding the loss of whitebark pine and the impact this will have on the grizzly population in and around Yellowstone National Park, comparisons are often drawn between the Northern Continental Divide Ecosystem (NCDE) and the GYE. This is largely because the grizzlies of the NCDE have adapted to a steady decline of the region’s whitebark pine forest. We have to be very careful, however, when comparing these two

ecosystems. The NCDE is one of the most succulent, rich landscapes in the Northern Rockies, an ecosystem where bears can count on impeccable berry crops almost every fall; whereas, the GYE is a high, dry, arid plateau. The grizzlies of the Yellowstone region don’t often have the luxury of turning to highly nutritious berries in a poor whitebark pine seed year. The grizzlies of Yellowstone have proven they can find alternative food sources in poor seed years, and their ability to adapt has been touted for decades; but how well these bears will be able to adjust to a declining food source as important as the whitebark pine seed at the same time that their habitat grows smaller and more tattered each year is a question no one can yet answer.

For those who recreate in grizzly country, bear encounters will likely increase. As whitebark pine seed production drives grizzlies to lower elevations, human conflicts inevitably await. According to Kim Sager from the University of Idaho, “2.3 times as many adult females and 3.3 times as many sub-adult males suffered human-caused mortalities during years when they did not use whitebark pine seeds.” This is a testament that the invaluable resource the whitebark pine provides the grizzly bear goes well beyond nutritional values.

And for those who cherish the opportunity to walk in wild country—in the presence of grizzlies—a saunter through the ancient whitebark pine forest on the south slope of Avalanche Peak in Yellowstone National Park is an unforgettable experience. But take a walk through this once-vibrant forest today and it is difficult to grasp the loss when walking amongst a sea of lifeless trees with the knowledge that this pristine piece of grizzly habitat represents a dying symbol of what once was.

It has been a challenging year for our nine-year-old sow and her cubs.

September has rolled into October and she has had little success this year in locating whitebark pine seeds. While searching each nook and cranny of the home range that was rich in this food source the previous fall, she ran into a male bear in no mood to share his limited resource. After a brief encounter, our sow walked away with one less cub.

Now there are two.

Though the fall begins with hardship and loss for the mother bear and her remaining cubs, there is much work to be done before journeying back to the security of their winter den. Because this is her second litter, the sow knows better than to venture into the river bottoms in search of easy food—unpicked fruit and human garbage—but she will do everything she can to ensure her cubs put on enough fat to make it through their first long winter’s sleep.

As the first storm of the late fall drops a dusting of snow, the three bears ready themselves to hunker down. The cubs have made it through their first season in a rugged and often dangerous landscape. Unfortunately, their opportunity to learn of one critical food source—the whitebark pine seed—has been limited.

We can only hope—for the sake of these cubs, and all the other grizzlies roaming the wild lands which abound throughout Yellowstone—that in years to come we will see a return of the precious whitebark pine seed crop to propel them through yet another season.