How Animals Send 'Tree Mail'

REMOTE IMAGING REVEALS FOREST COMMUNICATION

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Do wolves deliberately mark bear rub trees, or do bears specifically rub on trees marked with wolf scent? When an animal sniffs to pick up a message or urinates to leave one, is it just tracking its own species, or communicating with several? These and similar questions have kept us and our cameras occupied in Canada's forests for the past ten years—and what we're learning may help illuminate how animals communicate.

Since 1990 we have used remote cameras to document multi-species animal use of specific tree sites in seven Canadian Mountain National Parks. Our first observations began in Yoho National Park, British Columbia where we erected primitive remote monitoring cameras oriented to known bear rub trees to non-invasively study movement of uncollared grizzly bears (*Ursus arctos horribilis*). The cameras routinely photographed grizzlies rubbing specific trees. No surprise there. At one site, however, we were amazed to discover a group of 10 mountain goats (*Oreamnos americanus*) sniffing a bear rub tree. Some of the goats also rubbed the tree, and later images showed that passing mule deer (*Odocoileus hemionus*) would detour significantly to sniff this same tree. And so the intrigue began.

Courtesy of Parks Canada

As if leaving a fragrant calling card, a grizzly rubs a well-used "communication tree" in the Cascade Valley of Banff National Park. Remote-camera images also showed this bear biting and smelling the tree, and twisting its paws on the ground as it approached, likely to leave scent from glands on its feet. Other species also marked or sniffed this tree, perhaps to keep tabs on passersby.

Since then, as part of a large ecological inventory for Parks Canada, our cameras have operated over 16,000 camera nights oriented toward bear rub trees, some of which we now call animal communication trees. Our cameras have documented tree use by a wide range of mammal species including mule deer, white-tailed deer, moose, elk, bighorn sheep, mountain goat, gray wolf, coyote, red fox, Canada lynx, cougar, grizzly bear, black bear, wolverine, domestic dog, marten, red squirrel, wood rat, and porcupine.

"Use" includes a variety of behaviors. Many species would intently sniff the bear rub trees. Some would also urinate (canids and wolverines); scratch and bite the bark (bears); scratch the ground around the tree (canids, cougar, and lynx); rub the bark (mountain goat, bears, and wolverines); defecate (canids and felids); and spray or rub anal matter (felids and wolverines).

We documented such tree use not only by remote camera but also by intensive field investigation, especially during the winter when tell-tale tracks yield clues. Naturally there was variation in the use behaviors. Canid defecation, for example, didn't always occur at the immediate base of a bear rub tree. However, when we investigated the proximity of wolf scat locations to communication trees on a wildlife trail in Banff National Park, we found that 81.3 percent of all wolf scat found along the trail occurred within 20 meters of a communication tree, implying that rather than randomly defecating, wolves select sites in proximity to communication trees.

Trees as Multi-lingual Transmitters

Animal communication through the use of mark trees, wallows, exudates of various body glands, feces, and urine deposition is common and well-documented. Similarly, bear use of mark trees has been acknowledged for many years (Lloyd 1979, Hamer *et al.* 1980, Burst and Pelton 1983, Hamilton and Archibald 1985). Yet our information appears to be novel because it shows that *many* species are

using the same tree, presumably for communication. When marks from many species occur at one location, the possibility exists for an individual to learn the status of many other individuals of the same or different species within its community. The communication tree in essence becomes a billboard.

These heavily used trees are found on human or wildlife trails and back-country fire roads, as well as near older seismic and power lines. They don't appear to be special in terms of species, age, girth, or coarseness of surface, and we've observed no correlation to aspect, though they're more apt to be on the downhill side of a trail. Researchers in the Smoky Mountains of Tennessee and North Carolina have documented up to 34 species of trees used for communication by bears (Burst and Pelton 1983). The most common characteristic of these well-used trees is that they are often located at trail junctions—the points at which many different species would tend to cross paths.

Until we began documenting multi-species use of bear rub trees, we had believed that the trees were chosen and used solely by bears. Now we're unsure which species initiates a communication tree. Perhaps bears start the process by rubbing a tree, then other species begin to mark it—or vice versa. Adding to the mystery, not all communication trees are used by multiple species. Some are used solely by bears while other mammals pass by paying no attention to the site. So what makes a multi-species tree appeal to so many creatures?

From 2008 to 2009, using monthly field observations and remote camera records, we noted the species that marked or investigated 42 animal communication trees on a 24 kilometer trail in Canada's Banff National Park. Twelve species utilized trees previously used by bears. Though use was highly variable, 36 of the trees, or 85.7 percent, were marked or investigated by more than one species, and three trees received use by up to seven of the 12 species.

We must be clear that not all animal markings occur at animal communication trees, and not all animal encounters with these trees result in investigation or marking. In fact, our data suggest that less than 20 percent of large mammal passes result in investigation or marking. Often the communication is just one-way. Some animals just passively sniff, while others actively take and leave sign. An animal that actively communicates one time may passively communicate the next or disregard the site altogether. We observe, however, that the majority of active users of these community billboards are carnivores, while passive users appear to be largely prey species. This is intuitively logical, as prey may need to know what threats are in their vicinity while leaving no sign of their own presence.

Reading the Signs

The question remains: Why do multiple species of mammals mark or sniff one particular tree, and what messages do they leave or gain? Through the

Courtesy of Parks Canada

Caught in the act, a gray wolf scent marks a tree on the Fairholme Bench of Banff National Park. Three weeks later, remote cameras caught an elk sniffing the same tree. Researchers have documented moose, deer, elk, lynx, cougar, fox, wolf, coyote, marten, and other species (including the occasional male researcher) taking or leaving scent at a single tree.

Courtesy of Parks Canada

years researchers have explored at least the latter half of this question by studying the role of scent marks. Among their findings:

- Scent marking has been documented worldwide in many animals from bumblebees (Stout *et al.* 1998) to hyenas (Gorman and Mills 1984), and most terrestrial mammals appear to use some form of this communication.
- Scent marks are often made by individuals intolerant of and dominant to other members of the same species (Ralls 1971).
- Scent marking affects socio-sexual behavior and con-specific fertility (French *et al.* 1984), and therefore may reduce the need for aggressive encounters (Kruuk 1992). A bull elk in rut, for example, will show his prowess to both nearby males and his harem by rolling in urine, among other behaviors. In addition, scent marking can synchronize menstruation in females of a species.
- Marking may actually suppress fertility in some instances (Savage *et al.* 1988), while signaling sexual readiness in others. A study of 20 species of small cats found that reproductively active felids scent-marked more frequently than inactive felids (Mellen 1993).
- The behavior may be an evolutionarily inexpensive method of spacing out use or protecting resources. Some researchers note that many animals will repeatedly mark the same location, and at times the scents can be long-lasting (Rich and Hurst 1999), perhaps making them effective and reliable indicators of an animal's presence or passage.

We hypothesize that tree marks could convey a great deal of additional information about an animal, including its species, health, genetic suitability, age, interval of last passing, familial relationships, and territory. We would also not be surprised to find that the different types of marking that one individual can employ may serve discrete signaling functions. For example, a wolf may mark by rubbing, scratching, or depositing scent from feces, urine, or glands in the paws and anus. Perhaps each of these conveys a different message. Furthermore, the various forms of animal communications may be inter- and/or intra-specific. Deer may only be interested in other deer, for example, whereas a wolf may be interested in all visitors to a communication tree. At its simplest, active marking may simply provide comfort, as in scratching an itch, or be functional, such as removing hair. Ultimately, the "why" of tree marking is likely different for different species at different seasons.

If Trees Could Talk

Even if the messages remain obscure for humans, communication trees themselves warrant further study. Some of them have been used by many generations of animals, and could, therefore, have long-term significance for particular species. One study found that the average age of scarring made by bears on rub trees was 19.7 years (Lloyd 1979). Samples of a tree sawn at a lumber mill in British Columbia reportedly had bear hair embedded deep within the wood at rings dating back 150 years.

The effect humans have on these old, perhaps even ancient, billboards is unknown, but is likely significant. In a two-year study in Banff National Park, for example, we noted distinct differences in the degree to which grizzly bears used bear rub trees that humans had fitted with barbed wire to collect hair samples for DNA analysis. Our data show that family groups of grizzly bears used the wired trees almost 50 percent less frequently than non-wired (control) trees (Gibeau *et al.* in review). It may be that the wire, the scent of humans who attached it, or other factors dissuaded the bears to some extent, altering natural behavior.

Agencies that conduct prescribed burns or trail clearing to improve sight lines should be aware of the potential loss of these critical communication trees, which may have immeasurable value to many animals. Managers considering potential placement of backcountry facilities would also do well to survey the site for the existence of such trees, both to reduce potential hazards to humans and to protect wildlife values. Ultimately, saving high-use trees will also enable researchers to further study the grand extent of communication that may be occurring at these special sites, the "post offices of the forest." ■

For a complete bibliography and more images of animals at communication trees, go to *www.wildlife.org*.