

What's that buzz?

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Hike up to an alpine meadow in peak flowering season and take in the magnificent view. Then stop and listen. Can you hear the buzz resonating from blooms all around you? Watch for movement darting between one flower and its neighbor, or whizzing by to a distant patch of plants. Up here, you're deep in pollinator country, and what you see and hear before you is an intricate network of plants and animals that have coevolved over millennia to ensure each other's survival and success. Now focus more closely on the insects landing and feeding on the flowers, it's likely the first ones you'll notice are among the biggest and loudest—the busy, buzzy bumble bees.

Hardy bumble bees

Bumble bees thrive at high elevations and in northern latitudes; these sturdy insects are supremely well-adapted to live in cold, harsh environments. Their long fur keeps them well insulated, and their relatively large body size helps retain the heat. Bumble bees also have the remarkable capacity to raise their body temperature by “shivering” their thoracic muscles, allowing them to fly and forage in conditions that keep most other insects grounded. Bumble bees are generalist feeders, meaning they gather nectar and pollen from a large variety of plants over the short growing season, in contrast to the specialized diets of some other bees that limit where and when they can get food. Winter is the longest season in many bumble bee habitats, and the life cycle of the colony is adapted to minimize over-wintering mortality.

While bumble bees live in social colonies like honey bees, their colonies last only one year. In spring, queen bees that mated the previous summer emerge from winter hibernation. Each queen spends time foraging for nectar and pollen, then finds a suitable nesting site, typically in an abandoned rodent nest or a thick clump of grass. The queen then produces her first brood of worker bees. These bees will take on the job of foraging and feeding the young, as the colony continues to grow through the summer. Bumble bee colonies are much smaller than honey bee hives, and in the harshest climates may comprise 50 bees or fewer. Towards the end of the growing season the queen begins to produce fertile females (next year's queens) and males. Their mission is to leave the nest and mate with bees from other colonies. Newly-mated queens store sperm internally, and search for a place to hibernate for the winter. Each new queen will find or excavate a hole in the ground several inches deep, and as the temperature drops, she will produce anti-freeze (glycerol) to keep from freezing. As for the rest of the colony? They are no longer needed, and old queens, workers, and males will perish as autumn advances.

You can follow the life cycle of the bumble bee colony as you wander the mountains through the seasons. In late spring look for large, newly-emerged queens foraging and searching for suitable nest sites. During mid-summer, smaller worker bees will be busy and numerous, collecting nectar and pollen from many kinds of flowers. In late-summer, look for fresh, new, large queens building up fat reserves for the upcoming winter, and smaller males who may be patrolling for females or actively chasing them to mate. In the evening or during bad weather, you might also see males congregating in groups on flowers. Bachelors are not welcome in the nest once they've left home, and often hang out with other males overnight.

Diversity and mimicry

We typically think of tropical forests as the hotspot of biodiversity for plants and animals, but not surprisingly, this is not the case for bumble bees. In fact, there is a single species of bumble bee living in

the Amazon, and there are no bumble bees native to sub-Saharan Africa or Australia. Instead, travel to the mountains around the Tibetan plateau to find the highest diversity of bumble bees worldwide, or to other high elevations and northern latitudes throughout the northern hemisphere. In North America there are about forty-six species of bumble bees known; their diversity is highest in the western mountains but a few occur in Texas and Florida too!

How do you tell all those species apart? Fortunately, bumble bees are relatively large insects, and they are generally colorful with various combinations of black, white, yellow, and orange fur. Color patterns on the head, thorax, and abdomen can be extremely helpful in determining species, but unfortunately, a single species can be quite variable in its color patterns depending on its sex or where it lives. Then too, don't be fooled into thinking that every big fuzzy insect you see on a flower is a bee—mimics abound. For example, there are several species of flower flies that not only look like bumble bees, but buzz like them too! Some robber flies take on the fuzziness and coloration of bumble bees, but are actually fierce predators of bees and other insects. By mimicking bumble bees, these insects are trying to fool predators into thinking they can sting to defend themselves. One way to convince yourself that the insect you are looking at is a fly mimicking a bee is to count the number of wings you see: all flies have one pair of wings, while bees have two pairs.

Pollinators and thieves

There is a pervasive myth spread by tour bus drivers in Denali National Park in Alaska that the blueberries on which grizzly bears feast in late summer are primarily pollinated by mosquitoes. While it's admirable that the drivers are trying to make a significant connection between the health of animals that most park visitors adore (bears) and those they abhor (biting bugs), bumble bees should get the glory as they are by far the most efficient blueberry pollinators in the park! Blueberry flowers and other bell-shaped relatives, tomato plants and their kin, as well as alpine shooting stars, all have specialized anthers that require intense vibration to release their pollen. Bumble bees are able to perform this service for the plants using a technique called "buzz pollination" whereby they connect with the anther and use their thoracic muscles to vibrate the structure so that pollen is released from the tip. A few other bees are able to buzz pollinate, but honey bees are not capable of it. Growers of hothouse tomatoes know this well, and now can obtain commercially available bumble bees to pollinate their plants.

Other qualities contribute to making bumble bees consummate pollinators. Their dense, long, branched hairs carry large loads of pollen between plants. While much of this pollen is eventually groomed into the "corbicula" or baskets on their hind legs to take back to the nest (have you noticed the prominent yellow balls carried by foraging bumble bees?), inevitably some pollen will get brushed off as the bee moves between flowers, thus facilitating pollination.

Tongue length varies among bumble bee species, and allows multiple species to coexist in the same meadow, with the long-tongued species foraging on flowers with deeper or complex corollas (e.g., Penstemon, monkshood) and the shorter-tongued species on more open flowers. Short-tongued species may cheat to get at nectar in deeper flowers by chewing small slits at the base of the corolla allowing access to nectar from outside the flower, this is known as "nectar robbing." Next time you are in a patch of blueberry flowers, examine the base of the bells for small brown slits—evidence that nectar robbers have been at work!

As with all civilized societies, robbers, thieves, and social parasites comprise a sizeable subset of the bumble bee community. A special brand of thievery is carried out by members of the subgroup *Psithyrus*, commonly known as cuckoo bumble bees. Among these species there is no caste system of queens and workers, only females and males. The female cuckoo finds and invades the colony of a host species, kills the queen, and usurps the workers into foraging for and raising her own (cuckoo) young. There are seven cuckoo bumble bees species in North America.

Threats to bumble bees

Declines among some pollinators have been well-documented by scientists in recent years and this includes several species of bumble bees. For example, in the eastern US and Canada, the rusty-patched bumble bee (*Bombus affinis*) was a relatively common species until quite recently, but since the mid-1990's it has been suffering severe declines and has all but disappeared from most of its range. It is the only bee currently listed as a federally endangered species in North America (in Canada, not the U.S., yet). On the other side of the continent, the western bumble bee (*B. occidentalis*), once common from Alaska down to northern Arizona and New Mexico, has virtually disappeared in British Columbia, western Washington and Oregon, and northern California. The causes for these bumble bee declines are still under investigation, but are likely a combination of habitat loss and fragmentation, the use of insecticides and herbicides, the introduction of invasive species, parasites and pathogens (especially those carried by managed bumble bees in greenhouses and introduced to wild bee populations), and climate change.

Climate change may affect bumble bees in several ways. As temperatures rise, home ranges of different species may shrink or shift. Bumble bees restricted to northern or alpine tundra such as the polar bumble bee (*B. polaris*) or the high country bumble bee (*B. balteatus*) are losing habitat at the southern or lower edge of their ranges as shrubs and trees encroach into the tundra. But how much further northwards or upwards can these species shift? Scientists also predict that asynchronous shifts may occur in the seasonal timing of developmental events for plants and their pollinators. For instance, with warming temperatures, some plants may reach peak pollen and nectar production much earlier in the spring while peak foraging activity by bees lags behind. In this scenario, pollination services for plants are compromised, and bees go hungry.

What you can do for bumble bees?

Bumble bees are an integral component of the landscapes we love to visit as well as the places in which we live. As hardy as we know them to be, we also know their populations are at risk from a myriad of threats. Are there things we can do to help these truly irreplaceable and charismatic creatures? You bet! You have already started the process by learning more about bumble bee life history, natural history, and conservation concerns. Check out the resources listed below to learn more about all of these topics. No matter what region of North America you live in, whether rural or urban, you will have at least a few species of bumble bees living nearby. You can minimize your direct impact on bumble bee (and all pollinator) habitat by avoiding the use of pesticides where possible, especially the class of neuro-active pesticides known as neonicotinoids. These are taken up by a plant's vascular system and thus end up in pollen and nectar upon which bees feed.

Next, take active steps to enhance bumble bee nesting habitat and floral resources in your backyard. If you have a pile of brush or a patch of thick, long grass in the back corner that you've been meaning to clear out since last fall, consider leaving it in place. Other good places for nesting are abandoned rodent

burrows, spaces beneath rocks, or in hollow logs—if you notice a queen bee investigating a nesting site in the spring, allow her the space to set up if it won't interfere with human activity. In early spring, also consider the possibility that bumble bee queens are hibernating in your yard, and try to avoid disturbing the ground by mowing, raking, or tilling until after you see queens foraging. Offer good food. Plant a variety of bee-friendly plants (native is always best) that will bloom throughout the season, and offer different sizes and shapes of flowers for different pollinators.

And most importantly, as you hike up to flower-filled alpine meadows in mid-summer or through lowland hardwood forests in early spring, remember to stop and listen for the buzz of bumble bees. Their busy chorus tells us they are doing their part to ensure the health and integrity of the landscapes we love.

To learn more about bumble bees and other pollinators

In print:

Bumble bees of North America: an identification guide. P.H. Williams, R.W. Thorp, L.L. Richardson, and S.R. Colla. Princeton University Press. 2014.

Attracting native pollinators: protecting North America's bees and butterflies. The Xerces Society. Storey Publishing. 2011

On the web:

Xerces Society—Bumble bee conservation at xerces.org/bumblebees

Bumble Bee Watch at bumblebeewatch.org (help scientists document distributions of bumble bees by reporting your own sightings online!)

Virtual tour of Denali pollinators at nps.gov/rlc/murie/virtual-tours.htm