



Red Fox

Vulpes vulpes

Legendary for their cunning cleverness, red fox are equally at home in the trackless wilderness as they are in a tract-housing development. It has established itself world-wide, having the largest distribution of any land mammal - humans being the only exception. Even though it is the largest member of the “true foxes”, it is surprising to most just how diminutive red fox actually are. Males, or “dogs”, average about 11 lbs and females (vixens) 9 lbs. Large house cats tip the scales with more consequence.

When Red Ain't Always Red.

Their dominant coat color is typically, and this time not surprising to anyone, red - with black legs and ears, and a white belly and tail tip. But this isn't always the case. Fox coats are often darker at higher latitudes, with winter coats both darker and thicker. The melanistic and majestic [cross fox](#) has a black face, a mixed red/orange coat, and conspicuous black stripes down their backs and shoulders. There is also an all [black fox](#), while the so-called [silver fox](#) has a black coat but with silver tipped guard hairs, and on it goes. This seems like a lot of variation for a single species - and it is. They are so variable across their expansive range that red fox have been divided into no fewer than 45 subspecies. *Vulpes vulpes fulva* is the subspecies that occupies the northeast, and is just one of nine subspecies of red fox in North America. Along with coat color, variation between subspecies includes morphology (body shape), behavior, size, hunting habits, and habitat requirements. Our red fox veers from its European counterparts by having a stumpier snout, wider feet, and longer fur.

Vulpes vulpes fulva
Ed Sharron photo



What's Old is New

The natural history of the red fox is, in a word, complicated. Before the mass arrival of Europeans to the “New World” in the 1600's, red fox were native only to boreal and western montane portions of North America. They would not become common along the East Coast until the mid-1800s. So where did they come from? The most popular version

of their arrival has everything to do with aristocrats and their fondness for fox hunting. It seems the native fox species to our region, the somewhat smaller and shier gray fox, wasn't playing fair. Using it's tree climbing ability it would make the hunting hounds drop its scent and the horse-bound sportsmen would go home empty

handed. This sour grapes behavior led to the import and release of “Old Word” red fox into East Coast forests. Red fox here today are some combination of the descendants of those European red fox and the expansion of native North American foxes following the large-scale conversion of forest to agricultural lands by European migrants.

Serious Animal Magnetism

The small rodents that make up a large portion of a red fox's diet (meadow voles and mice primarily) tend to be more active during the day in winter, feeling safe in their tunnels under a thick blanket of snow. This consequently means red fox are more day-active in the winter as well, for whom even deep snow is no deterrent. Red fox have extraordinary hearing that can pick up low-frequency sounds, like nibbling rodents, and high-frequency sounds, like the squeak of a mouse, under even several feet of snow. In fact the red foxes' high-frequency sensitivity is comparable to domestic dogs, and at the low-frequency end to that of cats, making their absolute hearing range perhaps the greatest of all mammals.

Watching them hunt for rodents in deep snow is a true spectacle of nature. They are first alerted to their prey's presence by sound. When location is pinpointed, they take a flying, high-arc leap, steering with their tails on the way down with literal on-the-fly calculations being made to compensate for wind, distance, speed/trajectory of prey, and depth of snow. If the snow is deep it lands head first, up to 16 ft from where it launched. Whether it emerges with dinner in its mouth depends largely upon a previously unsuspected variable: magnetism.

A Czech study in 2011 observed 84 foxes hunting rodents over varying locations and times of day for 2 years. To their bewilderment, they observed that in deep snow or tall vegetation, if the fox leapt with its body aligned north/northeast, it was successful on 73% of its jumps, and enjoyed a 60% success rate when facing the exact opposite direction. All other jumps were only 18% meal producing - overwhelming failures. But why? Amazingly, it turns out the red fox could be homing in on the magnetic field of the Earth, a phenomenon known as magnetoreception. When it hears a mouse or vole chewing or squeaking (as far as 100 feet away and under as much as 3 feet of snow) it will cock its head from side to side and move its ears independently - rotating them as much as 150 degrees - creating asymmetry between ear height and position. This varies when sound arrives in each ear allowing the fox to estimate distance to



Left to right: A little Photoshop magic shows the relative size of a red fox to its larger canid cousins. | Red fox' eyes are a keen hunting tool, finely tuned to detect movement. When prey-like motion is spotted, it triggers their hunting instinct. | Red fox use the Earth's magnetic field to align their hunting leaps with great accuracy, then land head first on top of their prey.

prey while stalking forward, and helps them estimate prey location with great accuracy. Then, if circumstances allow, they will align their bodies towards the North Pole, (technically around 20° clockwise from magnetic north), take a flying leap, and come up with a meal almost every time. In contrast, when red fox are hunting in short vegetation or shallow snow, prey are more visible and the fox shows no bias towards any particular direction. While many other animals are known/suspected to use the magnetic field of the earth for orientation (birds, salmon, lobsters, etc.), red fox are so far the only example of magnetoreception being used to enhance hunting success.

A Night Sight that Shines Bright

When you look into the eyes of a red fox, you are not only taken by the obvious intelligence behind them, but the eyes themselves, with their vertically slit pupils and captivating bright amber/yellow color. It is unknown if that color provides any benefit, but if similar to other animals (squirrels for one) it may help to reduce glare in bright light, like when hunting on snow during the day. Their vertical pupils are similar to those of cats, typical of night-active predators, but are equally acute during the day. Vertically slit pupils can close more tightly than round ones. Paired with eyelids that shut horizontally, red fox can very precisely regulate the amount of light entering the eye allowing them to hunt across a wide variety of light conditions.

But night is where their eyes truly shine - figuratively and literally. Laying behind their colorful retina is a layer of highly organized reflective cells, we humans lack, called the *tapetum lucidum* (Latin for 'bright tapestry'). These retro-reflector cells reflect light passing through the retina (light lost to us) back through the eye in the same direction it came in on. This doubles the use of available light while keeping the sharpness and contrast of the image. The tapetum layer is also the culprit behind the eye-shine exhibited by many animals when caught in our headlights or the beam of a flashlight. The fact we lack that layer is equally the reason our eyes reflect a duller, devilish red in flash photography, since, somewhat gruesomely, the light

is reflected back by the blood in the retina. The exact color of red fox eye-shine varies upon the angle from which it is viewed. Adult fox being taller will mostly reflect a yellow/orange color, and shorter kits a blue/green.

The Sixth Scentse

One of the ways many wild animals communicate and keep social structure is through, what to us appears to just be peeing a lot, but in fact is the information rich practice of scent marking. Both males and females scent mark by strategically depositing scat and/or urine on prominent places like stumps, fence posts, exposed rocks, and at the intersection of game trails. Male urine takes on an especially strong, musky, skunk-like odor during peak mating season - usually in February in the northeast. Chemical analysis showed it is composed of one-third volatile sulfur compounds, a highly odoriferous substance more often found in mink and skunks. One whiff of these chemical signalling "sign posts" can reveal a fox's sex, status, and even individual identity. Marking territorial boundaries helps avoid aggressive conflict amongst foxes, as these boundaries are most often honored. Fights between neighboring foxes are usually more ritual than rage. Exceptions occur when young males are dispersing to look for territories of their own, during food shortages, or when mates are hard to find.

Red fox scent marking activity can be highly variable. They have been documented to mark up to 70 times per hour when on the hunt in a highly productive area, but tend not to scent mark as much in unproductive hunting grounds, and are even likely to tolerate intrusion from other red foxes there. Favorite hunting grounds however, can be vehemently defended. If the local fox population is sparse and food aplenty, red fox may hardly scent mark at all most of the year, breeding season aside.

For more information

- [Watch a red fox](#) take flying leaps as it hunts for meadow voles in deep snow.
- [Read about red fox](#) positive and negative effects on native biodiversity in this 2020 Rutgers research paper.



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