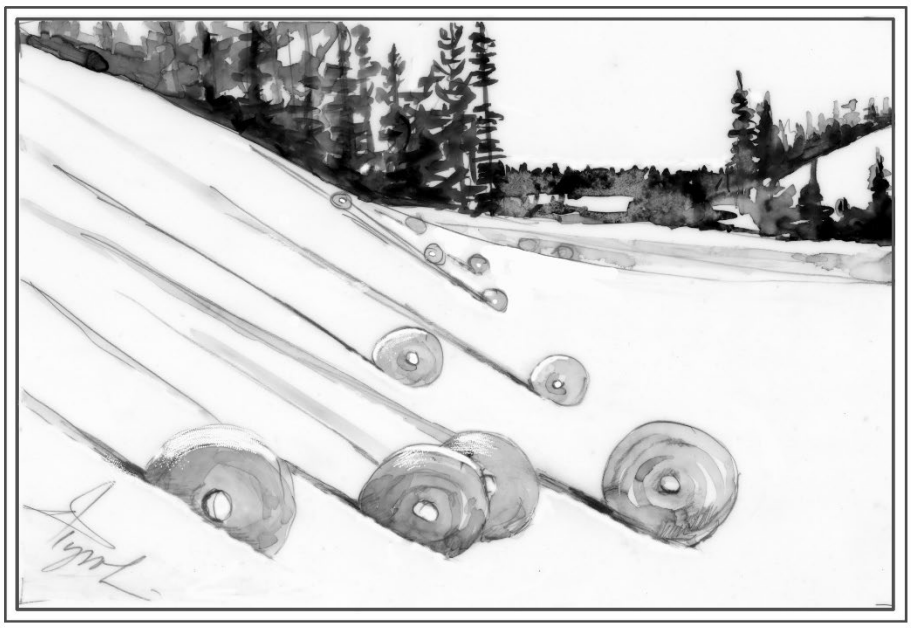
The Outside Story

Winter Wonders: Icicles, Snow Doughnuts, and Hair Ice

By Susan Shea



A few winters ago, I snowshoed along a trail that led below a series of cliffs with rows of huge, hanging icicles. These icicles were up to 40 feet long, with colors ranging from blue-green to yellowish-brown. In some spots, the icicles extended from clifftop to base, forming thick columns of ice. This spectacular display was created by water from melting snow and underground seeps dripping off the cliffs, refreezing, and building up over time. Minerals leached out of rock and soil can contribute to the colors of icicles.

Although less spectacular, icicles on buildings form in the same way. When sunlight or heat emitted through the roof of a poorly insulated building melts snow in subfreezing temperatures, the water refreezes as it drips. Because of the influence of sunlight, more icicles tend to grow on sunny, south-facing sides of buildings and cliffs than on shaded north sides.

An icicle begins its life as a single drop of water hanging from an object in cold air. As the drop starts to freeze, a thin outer shell of ice forms. Water continues to flow down the sides in a thin film, creating more freezing and allowing the icicle to lengthen over time. Actively growing icicles have liquid drips at the tip and a narrow, liquid-filled tube inside. Naturally-occurring salts and other minerals in the water cause ripples on the outside of an icicle. Icicles also develop when rain falls in air slightly below freezing, and rainwater dripping from branches and wires creates an accumulation of small icicles. The rate of growth of an icicle in length and width is a function of air temperature, wind speed, and water flux. Icicles can grow as fast as one centimeter per minute.

While icicles are a common seasonal sight, other winter weather phenomena are more unusual. On warmer winter days, I've occasionally seen long tubes of snow, either hollow or filled, on steep slopes. These are snow rollers, or snow doughnuts. For these unique shapes to form, there must be a

top layer of fresh, sticky snow, a substrate such as ice or powder that the top layer doesn't adhere to, a temperature just above freezing, and a wind. On hillsides, gravity aids in their formation. Snow rollers can also occur in fields and on frozen lakes where a strong, sustained wind does the work. As a strip of snow rolls down a hill or is blown across a field, it turns over, accumulating more snow and creating a layered, cylindrical, shape.

"The Vermont Weather Book," by David Ludlum, describes hundreds of snow rollers in fields near Burlington, Vermont, that were up to 13 inches in diameter and 18 inches long. The National Weather Service once reported a large occurrence of snow rollers on an Idaho prairie that were up to 2 feet in diameter. Most snow rollers are smaller, some as small as a tennis ball. The weather service considers snow rollers a rare meteorological event because they need a specific combination of conditions to form.

Another interesting, uncommon cold weather phenomenon is hair ice, also called ice wool or frost beard. These are thin filaments of ice that grow out of rotting logs and are packed together in soft curls and waves resembling human hair. Hair ice occurs on humid nights in northern forests when the temperature is slightly below freezing. This ice often melts in the morning, although it sometimes maintains its shape for days. In 2015, Swiss and German researchers discovered a species of fungus that grows on dead tree bark and can cause hair ice to develop. When ice forms on the surface of a log, and the water inside the log remains liquid, the temperature difference produces suction that draws water out of the wood pores and grows the "hair." Chemicals released by the fungus shape the ice into strands.

Along with the challenges of icy roads and snow shoveling, winter offers a host of wonders if you take the time to look.

Susan Shea is a naturalist, writer, and conservationist based in Vermont. Illustration by Adelaide Murphy Tyrol. The Outside Story is assigned and edited by Northern Woodlands magazine and sponsored by the Wellborn Ecology Fund of the New Hampshire Charitable Foundation: www.nhcf.org.

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PO Box 270, Lyme, New Hampshire 03768
mail@northernwoodlands.org / 603-795-0660
www. northernwoodlands.org

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