

Water in Winter

By Diana Thottungal



Water is wonderful stuff, but in the winter it becomes almost magical. Cold and humidity combine to produce an amazing array of solidified water forms.

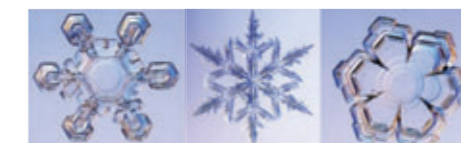
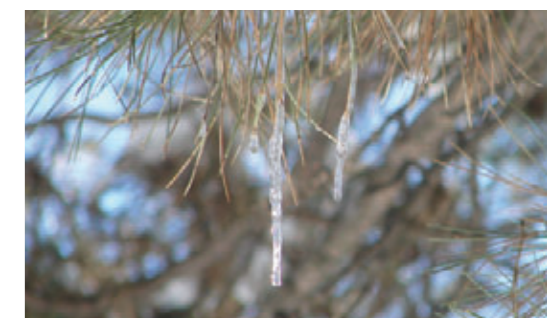
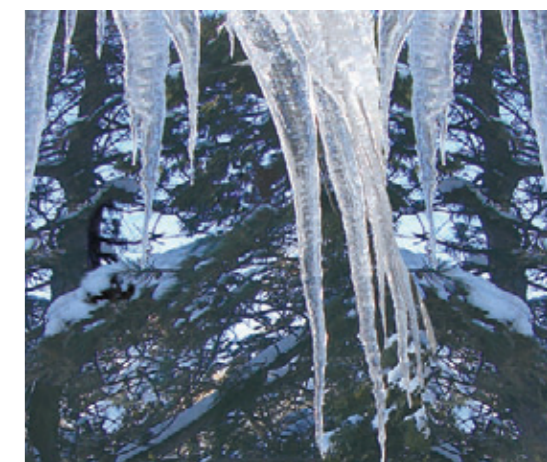


Frost Flowers

Sometimes water in a plant stem freezes and splits the stem. It only happens when the air is at freezing temperature or below and the soil has not frozen yet. After the stem has split, capillary action pushes more liquid up and out into the freezing air, enlarging the feathery flowers.

Two plants in the Garden that might form frost flowers are blue salvia (*salvia azurea*) and periwinkle (*vinca minor*).

on how cold it is and how big the icicle already is, which is why there are always bumps and ridges on big icicles. They can curve, too. You've probably already seen this on icicles that face east or west with the sun on only one side during most of the day. The icicle will curve away from the sun as in the picture above. Icicles can form anywhere, even on pine needles.



Water in the Winter Sky

When the sun is low in a clear winter sky, with just a few wispy (cirrus) clouds around, there's a chance to see a halo, and on either side of the halo, bright spots called sundogs.

The cirrus clouds are made of ice, and the air around them also has ice in little flat hexagonal plates. If the plates are falling helter-skelter, the dog will just be a bright spot, but if they are falling with the flat edges parallel to the ground a spectrum will be visible.*



Crystallized Dew – Hoarfrost

Sometimes when you step outside in the morning after a clear frosty night in early spring or late fall, the edges of leaves and grass blades are trimmed with a lacy edging of ice crystals. This is called hoarfrost and happens when dew or water vapor freeze, usually below the regular water freezing point (super-cooled).

Since cold air is denser than warm air, it flows downhill so that the hoarfrost forms in low areas or hollows. You can see this effect in Camille Pissaro's painting (above), *Gelee Blanche* (Hoarfrost).

Hoarfrost may also be called silver frost or white frost. An unfortunate aspect of hoarfrost is that if it forms on top of deep snow it can lead to avalanches.

Frozen Fog...Rime

Frozen fog is called rime and is the result of moist foggy air touching cold surfaces. It condenses and freezes, forming a glaze or sometimes crystals that look like bits of snow.

It comes in hard and soft versions. Hard rime is found on the side of a tree that faces the wind, doesn't shake off easily (as would snow) and has a whitish look.

Soft rime can look like hoarfrost, soft and white. Glaze, which is clear and glassy, is not a form of rime; instead, it is the result of freezing rain.

The photograph of *Tashiro Pond* with morning fog (above left) is the best I have seen illustrating fog condensing near trees, forming rime.

An easy way to remember the difference between hoarfrost and rime:

- Rime forms inside freezers
- Hoarfrost forms outside freezers on frozen food taken out on a humid day.



Ice Needles

Frost flowers are related to ice needles, a kind of upside down icicle that forms under the same conditions. If the ground is just a bit above freezing and the air is below freezing, the frozen surface bits get pushed up by capillary action. Then that bit freezes, and so on. The result is needles of ice rising from the ground.

Icicles

Icicles are much more complicated than just dripping water that freezes. The sun has to warm some snow, which melts and drips, but how far it drips depends

Credits

Gelee Blanche: http://upload.wikimedia.org/wikipedia/commons/8/85/Camille_Pissarro%2C_Gelee_blanche_%28Hoarfrost%29%2C_1873.jpg

Tashiro Pond photo © Hiroki Suzuki. Reprinted by permission. More of Mr. Suzuki's work can be seen at <http://homepage2.nifty.com/hsuzuki/english/>

Frost flower photos permission of James Carter from the website Ice Yard 08 at <http://my.ilstu.edu/~jrcarter/ice/yard-2008/>

Ice Needles from http://commons.wikimedia.org/wiki/File:Shimobashira_01.jpg

Snowflake images © Kenneth G. Libbrecht, who has an excellent website at <http://www.its.caltech.edu/~atomic/snowcrystals>. A snowflake formation chart is available from the Alaska Lake Ice and Snow Observatory Network at http://www.gi.alaska.edu/alison/ALLISON_Science_Snow.html.

Halo and Blurry Sundog near Rochester, MN © 2005 Diana Thottungal

Diana Thottungal is a naturalist at the Eloise Butler Wildflower Garden.

Icicle Theory, Practice and Weirdness

By Diana Thottungal

The theory part is pretty easy. Sun, or heat escaping from the attic, warms piled up snow on the roof. Snow melts and starts to drip down. But the air is still cold and freezes the drip. *Voilà*, an icicle is born.

Out in the woods, snow can be piled on dead leaves that have not yet fallen or on conifer needles, but the effect is the same. Leaves or needles that are busy photosynthesizing release and radiate heat the same way poorly insulated attics do.

End of story? No.

Icicle Tips: They look pointed but really are tiny

inverted cups that hold the drops as they form.

Curved Icicles: These do make sense. If one side of the icicle is consistently exposed to the sun, the water stays melted, or gets melted on sunny days, producing a curve that bows in on the sun side and out on the shade side.

Bumps and Ridges: They look random but aren't. First, the distance of the bumps from peak to peak is consistent. Second, they apparently vary in number according to the hardness of the water. And third—most amazing—it seems that these ripples move upward as the icicle grows!

Branches? In very still air, an icicle can develop a tiny branch. And, if they can grow from a roof or a leaf, they can also grow from a leafless tree or shrub branch, as

the Wikipedia picture at this site shows: <http://en.wikipedia.org/wiki/File:Icicles.jpg>.

For more information about icicle research, please see: <http://www.mendeley.com/research/experiments-morphology-icicles-9/>

<http://www.insidescience.org/current-affairs/1.1854>

—Diana Thottungal is a naturalist at the Eloise Butler Wildflower Garden

Published in the Fringed Gentian™, Jan. 2012, Vol 60