Soil and Ice – Frost Heaves
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More snow, more ice – what an inauspicious beginning to the International Year of Soils.

As soils freeze and thaw, ice layers can also form underground. The most common ice and soil feature that we see in New Hampshire is the ubiquitous Frost Heave.

Frost heaves

When water turns into ice, it expands. When it happens underground, it can cause the overlying material to lift upwards, which is known as a frost heave. Frost heaves can be strong enough to damage roads, bridges, buildings, foundations and railroad tracks.
Frost heaves are the result of pressure created from a combination of freezing temperatures and the soil defrosting. The fluctuating freezing and thawing conditions heave, or lift, the soil, which is often characterized by deep cracking of the soil. Fence lines can be lifted and disturbed, as well. Plants may even be uprooted from the ground. For some farmers, this can become a major issue, as entire crops can be lost or damaged. Plants can quickly dry out and die once their roots have become exposed to cold temperatures. This damage can range from minor to major depending on location, weather conditions and soil structure.

While frost heaves usually occur in early spring, they can form anytime temperatures fluctuate above and below 32 degrees (F). Frost heaves result from a combination of cold air and adequate soil moisture. As the cold sinks to the ground, water within the soil starts to freeze. Any additional moisture, such as water from the soil defrosting and the ice melting, is drawn upward, which also freezes. When water freezes, it expands, creating pressure—both upward and downward. It is this pressure which causes a frost heave to occur. Heaves are also more likely to happen in soil textures such as loam, silt, and clay, which are moisture-retaining. An excessively drained soil, like that of coarse sand, rarely if ever suffers from frost heaving issues.

The soil particles and air spaces in the soil can act like little straws. As the cold temperatures start to go down into the soil, they actually suck or draw up water from below which is called capillary action. As the water comes up, it hits the freezing front and of course, expands and pushes upward.
Although frost heaves cannot be completely eradicated, they can be prevented. Most heaving problems begin in low-lying areas of the landscape. Dips or depressions in the ground hold water. With the right soil and freezing temperatures, a frost heave is inevitable. Therefore, it often helps to rake or smooth out these areas in order to minimize frost heaving threats. Soil moisture can also be alleviated by amending the soil with compost. Not only will this improve drainage issues, but it can also help with soil structure. A well-drained or excessively drained soil also warms up faster, further decreasing the occurrence of frost heave. Another way to warm the soil is by applying mulch, where suitable. Mulch helps insulate the soil by regulating temperature fluctuations and reducing frost penetration.

See the following links to view a few soil and ice videos:

Ice lensing: [https://www.youtube.com/watch?v=BN7KfpDUi60](https://www.youtube.com/watch?v=BN7KfpDUi60)

Ice needles: [https://www.youtube.com/watch?v=Rfn5mkdFM3Y](https://www.youtube.com/watch?v=Rfn5mkdFM3Y)

The effects of frost heaving on a foundation: [https://www.youtube.com/watch?v=9jyczX380PA](https://www.youtube.com/watch?v=9jyczX380PA)

Frost action in soils: [https://www.youtube.com/watch?v=ufdf8mm00pc](https://www.youtube.com/watch?v=ufdf8mm00pc)