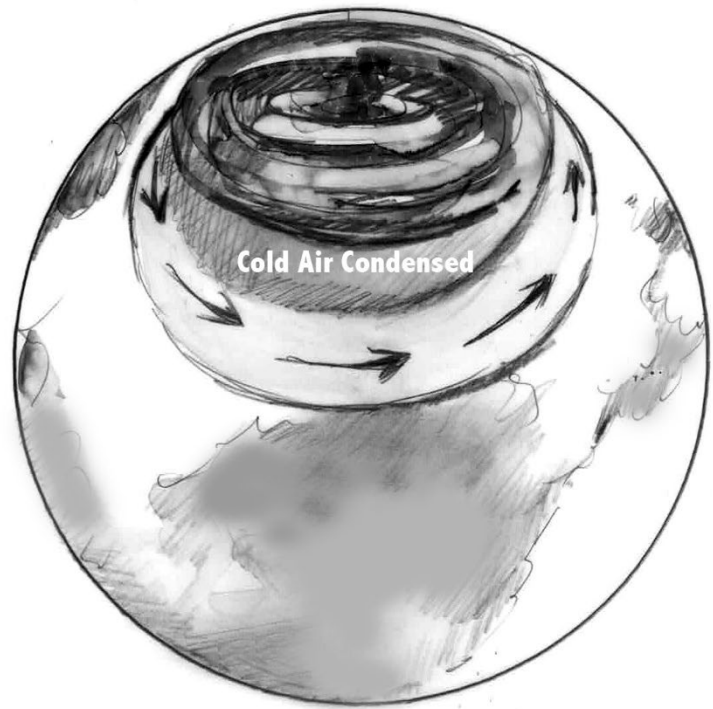


The Outside Story

Survival in the Cold

By Jen Weimer

The new year ushered in an arctic blast that has only recently let up. This extreme plunge in temperature is referred to as a polar vortex. While it may seem that this is a new term, it has been in use since the 1800s. These periods of intense cold can impact the survival of many native and invasive species, including plants and pests.



The polar vortex is a large area of low pressure and cold air in the stratosphere, the upper level of the atmosphere. While it exists year-round near the earth's poles, its effects are most noticeable in the winter months when it expands, allowing frigid Arctic air to spill southward into North America, Europe, or Asia. These cold spells can last anywhere from a few days to a few weeks.

Polar vortex events in the Northeast can have complex effects on native and invasive species. The cold snap associated with the vortex can kill invasive species less acclimated to the cold, but it can also select for hardier, more resilient populations – which can aid the survival of cold-tolerant invasives. Native species often rely on consistent seasonal patterns for growth and dormancy. A polar vortex followed by an early thaw can stress native plants and some invasives may capitalize on the disturbance. Certain invasive plants like common reed (*Phragmites australis*) and buckthorn (*Rhamnus* spp.) are well-adjusted to cold climates, allowing them to persist despite harsh winters. Invasive plants that thrive in milder winters, like Japanese honeysuckle (*Lonicera japonica*) or kudzu (*Pueraria montana*), may suffer dieback if prolonged cold temperatures damage their tissues.

Sudden extreme cold can also kill off insect populations that lack adaptations to deep freezes. For example, the southern pine beetle (*Dendroctonus frontalis*) has been expanding northward, but extreme cold snaps have been shown to limit its spread. Studies have also shown that a strong polar vortex can result in up to 95% mortality for brown marmorated stink bugs (*Halyomorpha halys*). The emerald ash borer, on the other hand, has shown the ability to better withstand colder conditions

through a process called phenotypic plasticity, which allows them to adapt to colder conditions without necessarily undergoing genetic changes; their bodies adjust to produce more antifreeze-like compounds to tolerate lower temperatures. While a polar vortex event that occurred in 2019 caused significant mortality of EAB in the Midwest, many survived, and populations have rebounded.

The polar vortex can have a significant impact on hemlock woolly adelgid (*Adelges tsugae*) (HWA), though its effectiveness in controlling the invasive pest depends on how extreme and long-lasting the cold temperatures are, and when they occur. Research shows that significant mortality occurs when temperatures drop below -20°F, or when there are prolonged subzero temperatures. Sustained cold winters are more effective than a single extreme event for slowing HWA expansion. However, cold snaps that occur in early spring — when HWA are laying eggs — can contribute to high mortality. Polar vortexes may also have an impact on HWA predator populations, such as beetles in the *Laricobius* genus, which are susceptible to extreme cold and feed on HWA in late winter.

While deep cold events can slow the spread of some pests, other invasives that are adapted to extreme conditions may thrive. Even after a polar vortex kills a large portion of the population, surviving individuals may be more resilient, meaning future generations could withstand colder temperatures. As winters become more variable, invasive species will continue spreading into northern regions that were previously too cold for them to survive. The polar vortex can provide relief by knocking back certain invasives, though native species may suffer at times as well. With milder winters, but increases in abrupt temperature swings, it is important to continue to pay attention to how polar vortexes impact ecosystems and individual species, as we will see more periods of sudden extreme cold in the coming years. While cold temperatures have recently let up, we will continue to see the impacts shaping plant and pest communities in the months to come.

Jen Weimer is a forest health expert, photographer, and writer living in the forests of New Hampshire. Illustration by Adelaide Murphy Tyrol. The Outside Story is assigned and edited by Northern Woodlands magazine and sponsored by the Wellborn Ecology Fund of New Hampshire Charitable Foundation: nhcf.org.

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Woodlands**

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

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