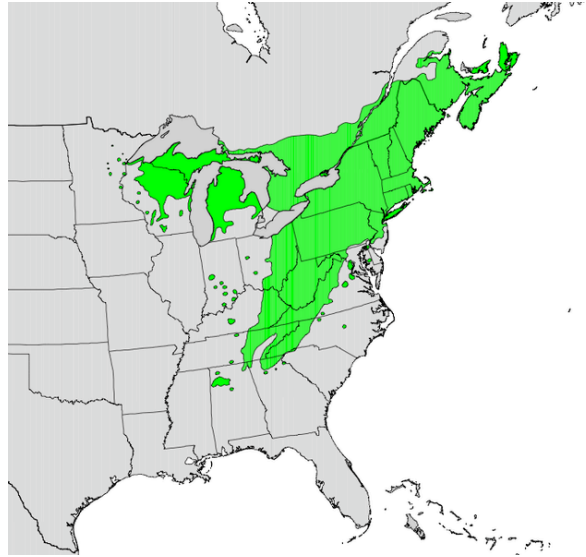


## Seeking cooler climes: Plants shifting ranges in response to climate change.

### What is a "Range Shift"?

Gardeners and farmers all over the country will be aware of the recent shift in plant hardiness zones, which reflects a change in where plants can survive. "Range shift" refers to the phenomenon of a species' range moving in response to changes in conditions.



### Why does it happen?

Species ranges are typically defined by temperature and resources. An rise in the lowest temperature of an area means that plants that are ordinarily killed or harmed by long, cold winters can move into new areas as conditions become more favorable. Likewise, plants that require a freeze as part of their reproductive cycle will cease to grow in areas that become too warm.

The other major determinant, or cause, of location is water. A change in precipitation, be it an increase, a decrease, or a change in seasonal timing, can make one area more hospitable and another less so.

An emerging factor is the rise of parasites that have, historically, been bounded by cold winters. The Hemlock Woolly Adelgid (*Adelges tsugae*) is one example of a species that is suspected to be susceptible to cold. The winters of the north may be slowing its spread, but as the climate warms, they will be able to move into new territory.



The final driver is the movement of one species triggering a shift in another. As the climate warms, and cold-sensitive species move into new areas, they may out-compete the species adapted for winter, and as a

result, the range shift of one plant species can force a shift in another.

### **Is it happening now?**

The ranges of a number of species have been expanding northward and uphill, for the most part, towards historically colder areas. The importance of water, however, has been made clear through the observation of some species moving *downhill* in response to drier conditions on the mountaintops

### **Why is this a concern?**

To a certain degree, it's not. Changes in range are an indicator that the climate is warming, but they are also an indicator that plants are moving to cope with that warming. On the other hand, the network of highways, cities, and other human-made landscapes mean that very often species that are moving to more hospitable regions run out of places to move to. This fragmentation of the natural world has resulted in a landscape filled with obstacles and barriers that make it difficult if not impossible for plants to escape the heat, and move to new areas.

How fast can plants move? Historical studies of trees moving north as the glaciers retreated after the last ice-age suggest rates ranging from 100m to a kilometer per year. Under current climate changes, the southern limit of some species might move north faster than this, causing die-offs in some parts of the species' ranges. Here again, humans' modification of the landscape may slow plant migrations even more.

### **What's the outlook?**

As the climate continues to warm, we will see changes occurring more rapidly. Species with broad ranges, like the Eastern Hemlock (*Tsuga canadensis*), will be able to cope with the temperatures, but as mentioned, may have a range shift in response to spreading parasites. Species that cannot move, or cannot keep up with the rate of warming, will either cope with the changes, or die out.