

A few years ago I visited a friend in North Carolina. From his lakefront house, as we pattered into the waters on his pontoon, I noted that certain trees ringing the shore were cocooned in spider webs. Wouldn't the trees suffocate in their shrouds? My friend said something about the pests spreading from neighboring trees. He sold the property soon after.

In July 2010, record-breaking monsoons brought nearly 10 years worth of rainfall down on Pakistan—within one week. Rivers overflowed, flooding huge areas. Since they had nowhere to go, the waters couldn't recede. Huge stagnant bodies of water dotted the countryside, breeding mosquitoes that assaulted millions of people already health-compromised and homeless.

In other ways, too, it was a slow-motion disaster. Spiders sought refuge in the trees, spinning webs that covered each tree as a whole. These trees became massive cocoons. People standing under the trees had lots of little spiders falling down on their heads. This type of spider travels in groups and makes a community, capturing prey and sharing with others of its kin. Perhaps it was the kind of spider activity I observed in miniature at a Carolina lakeshore.

A species closer to home is the pine beetle. The tiny critters have achieved the worst beetle epidemic in recorded history. Some foresters still claim it's a cycle that'll end any day now, but if there is any lessening of beetle activity, it's because it's preferred lodgepoles and white pines are dead.

Researchers Jeff Mitton and Scott Ferrenberg at Colorado University have observed that the pine beetle now achieves two generations per summer. Since the 1970s, warmer weather and longer summers along the Front Range have allowed the beetle to proliferate. It has more than doubled its flight season, from 50 days up to 120. And the effect on the beetle population is potentially exponential; instead of one female generating 60 offspring a year, those offspring could generate an additional 3,600 pine-munching hordes in the same season. Additionally, warming temps have sent the beetles to elevations of up to 10,000 feet, where they could not have survived in earlier times. The researchers found them in pines along Niwot Ridge west of Boulder, home of the university's Mountain Research Station.

The CU discovery comes in the sixteenth year of an epic mountain pine-beetle outbreak in the western United States and Canada, the worst infestation of its kind. In Colorado, what began as a flare-up in lodgepole pine in isolated pockets on the Western Slope in 1996 has left large swaths of doomed, red-needled trees and denuded gray ones across 3.3 million acres, including thousands of ghost trees in popular tourist areas such as Vail and Dillon. Aerial surveys indicate that the affected area grew by 140,000 acres in 2011, mostly in ponderosa forests in the northern part of the state. The accelerated life cycle, the CU researchers suggest, is a direct response to climate change. The decimated trees are fuel for wildfires that desiccate the soil, reinforcing the warming cycle.

Southern Wyoming has also been hit hard. So have pine forests in California's San Bernardino Mountains. Onward march the beetles, from the Front Range to New Mexico to Yellowstone to British Columbia. In Western Canada, the pine mortality has become so extensive, releasing so many megatons of carbon dioxide from tree decomposition into the atmosphere, it may transform the country's forests from a carbon sink to a carbon source.

In line with overall species-migration patterns, the bugs are heading northward. Conservationists worry that the beetle will move into Canada's continent-spanning jack pine forests. Those forests would provide a superhighway that the beetles could follow to infest pine forests in the eastern and southeastern United States.

Researchers in Britain analyzed dozens of studies tracking changes of some 1,376 species of plants, animals, and insects. They found that a warming climate is driving species toward higher latitudes at an average of nearly twice the pace than studies suggested in 2003. And the species in the regions experiencing the most significant warming over the past 40 years are the species moving the most quickly.

It's an amazing story—and a disconcerting one—of our warming climate's effect on a broad range of organisms. Beyond its observations about plants and animals, the British study hints at looming challenges for people and their economies.

“The shifts in the range of species and the fact that the shifts are moving faster have huge implications,” explains Frank Lowenstein, who heads the Nature Conservancy's efforts to find how natural systems might help humans adapt to global warming. Meanwhile, farmers watch their crops suffer the onslaught of unmitigated heat waves. Further headaches come with plant diseases that appear in very hot weather: fungus and crop pests like spider mites; rootworms or Japanese beetles. The spider mites attack the leaves of corn and soybeans; the rootworms feed on corn roots, causing heavy damage to each plant. Grasshoppers, too, have invaded farms in huge numbers.

Climate is not one thing that covers the globe; rather, it's a sum of weather patterns, ocean circulations, storms and droughts and clouds. Likewise, ecosystems are not simply based on a hierarchy of human needs; food webs interact with one another in various degrees of complexity.

We live in an era of unprecedented environmental decline, a human-caused calamity that's erasing much-needed food species while proliferating invasive ones. “Why the human race may cause its own extinction” is the subtitle to Fred Gutierl just-published “The fate of the species.” He conjures up a “regret scenario” where “we might look back in 2050 and think that we might have been able to prevent all that Arctic melting or changes in precipitation,” and he sounds a note of warning: If we continue to disrupt the ecological systems and the natural cycles that make our planet habitable, civilization as we know it will disappear.