BULLETIN SYNOPSIS

New Evidence of Tree Species on the Move

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There has been significant debate and research about where, how quickly, and to what degree our forests will shift with the changing climate. Researchers have used observational data to detect early signs of forest migration, but results have been mixed. In this bulletin, we highlight a noteworthy new study in the eastern U.S. showing significant changes in abundance for a number of tree species.

New Evidence of Species Shifts

A recent study by Fei et al. (2017) found "prominent westward and poleward shift in abundance for most tree species in the eastern United States during the last 30 years," providing some evidence that eastern species are responding to recent changes in climate.

Researchers used data from the U.S. Forest Inventory & Analysis (FIA) program for 86 species/groups in the eastern U.S. They examined shifts in sapling and adult tree abundance, including the relationship with climate, successional status, functional traits, and evolutionary lineage. They found:

- Distinct spatial patterns, e.g. 73% of species shifted their abundance centers westward and 62% shifted poleward
- Greater shifts in sapling than adult abundance
- Influence from climate (especially changing moisture availability) and successional status
- Different shifts depending on species traits, e.g. drought tolerance, wood density, seed size
- Different shifts depending on phylogeny, e.g. >81% of angiosperms shifted westward, while >71% of gymnosperms shifted northward

The results suggest vegetation dynamics are more sensitive to moisture than temperature and changes in relative competitiveness among species (due to variation in physiological tolerance and dispersal ability) determined the shifts that were observed.

See the full bulletin for more details about the methods, results, and implications of the study.

Previous Research

Upslope or poleward shifts have been documented for tree species in temperate, boreal, and even tropical biomes. Although, most studies (including Fei et al.) show discernible shifts for only a portion of species. Not all tree species are responding to recent climatic change, and some are responding in ways we might not expect, due to the complex array of factors that determine species ranges (e.g. inter-species competition, moisture availability, adaptation). Fei et al. (2017) is different from many preceding studies in using abundance data throughout the species range (rather than focusing on range margins) and in the large number of species for which they detected significant shifts.

Take Homes

Current scientific understanding suggests some general rules-of-thumb regarding forest migration:

- Tree species will respond independently, not as cohesive forest types
- Significant time lags are likely
- Potential for faster change with mortality from extreme events
- Changing moisture availability may be more important than temperature in the near-term
- Most species will experience climate conditions that are novel for that species (in some portion of their range)
- Look for initial changes in forest composition at range margins and in the regeneration layer
- Generally, expect range expansion at northern and higher elevations, range contraction at southern and low-altitudinal limits

Things to Do:

Two important things forest managers can do are (1) monitor for changes in regeneration success, relative abundance, and/or competitiveness among species and (2) promote regeneration (the stage when species have the best opportunity to adapt through phenotypic plasticity).

Click on the sub-headings above to go directly to the corresponding section of the full bulletin, or read the complete bulletin online: http://climatesmartnetwork.org/2017/05/new-evidence-of-tree-species-on-the-move/