Tree Sway Before and After Forest Management

A Preliminary Look at Changes in Movement

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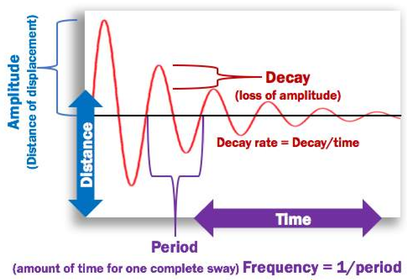
41 trees in roadside forests in Connecticut were outfitted with biaxial inclinometers to track their sway motion through a *Stormwise* forest management treatment.

Dynamic tree characteristics (frequency and amplitude of sway) are related to a trees ability to withstand damage from the wind, and morphological characteristics of the tree.

Anatomy of a Tree Sway Signal:

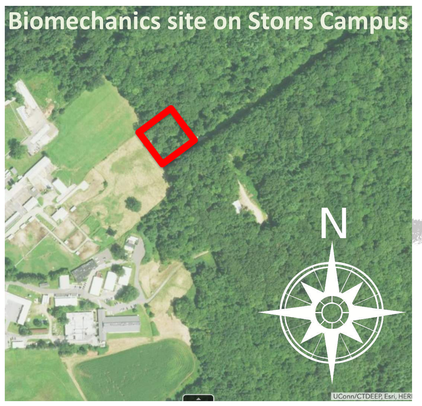


6 trees are plotted in this preliminary data exploration.

These "sway prints" plot the movement of the center of the crown over a 3-hour period:

1) at the start of the biomechanics study
2) in the second year after a thinning treatment was implemented in the stand
3) 4 years post-treatment

3-hour time frame wind conditions:
Maximum Wind Speed: 10.5 m/s
Average Speed: 4.5 m/s
Average Wind Direction: 90-180 degrees (from the southeast, the direction of the gap alongside the site)



Tree# 4230
Black birch
Diameter: 12cm
Height: 14m
Crown radius: 2m
Overtopped in canopy
Interior in stand

Tree# 4193
Sugar maple
Diameter: 18cm
Height: 17m
Crown radius: 3m
Overtopped in canopy
Interior in stand

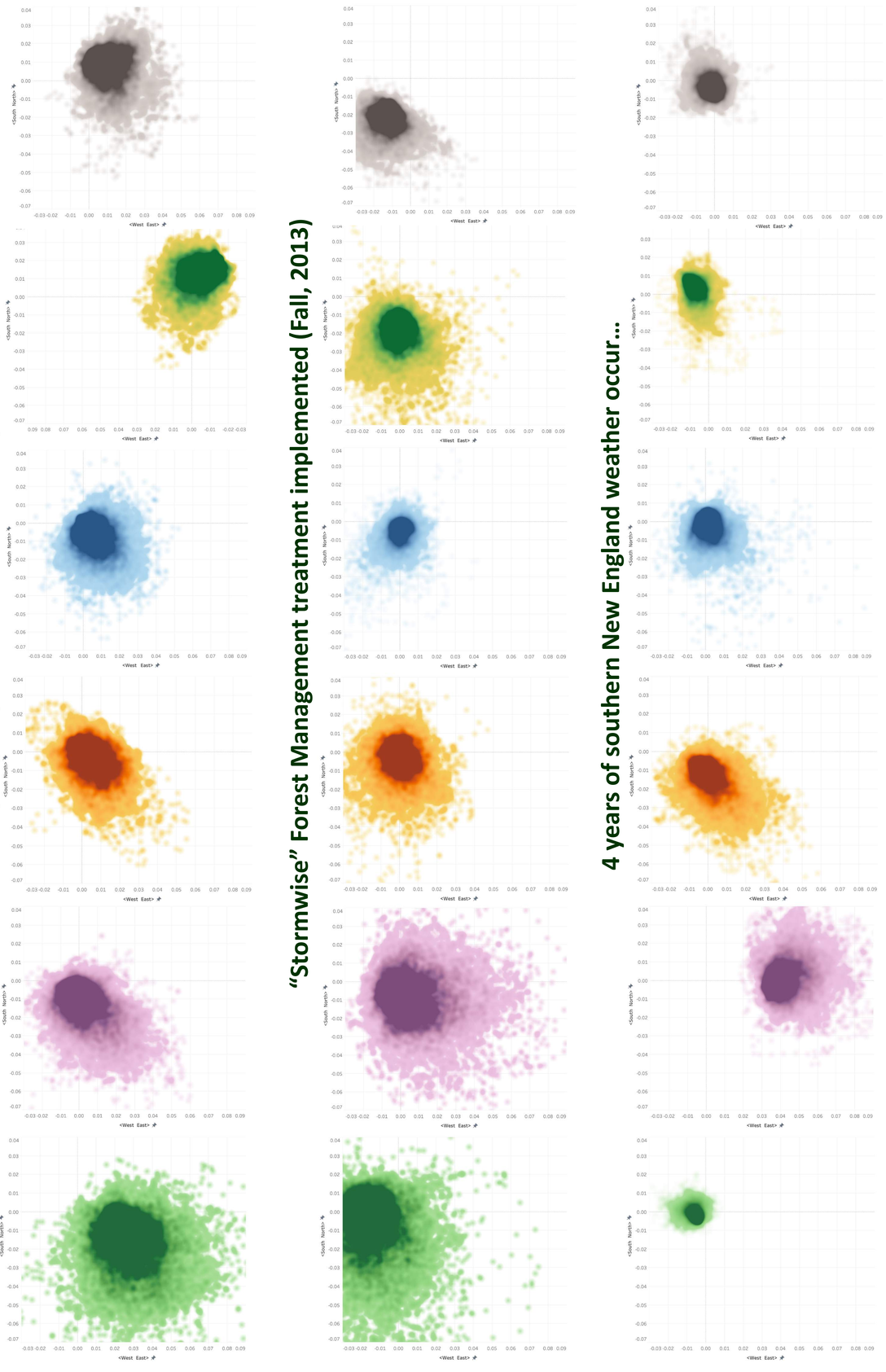
Tree# 4444
Sugar maple
Diameter: 23cm
Height: 18m
Crown radius: 3m
Overtopped in canopy
Interior in stand

Tree# 4133
Shagbark hickory
Diameter: 30cm
Height: 22m
Crown radius: 6m
Co-dominant in canopy
Interior in stand

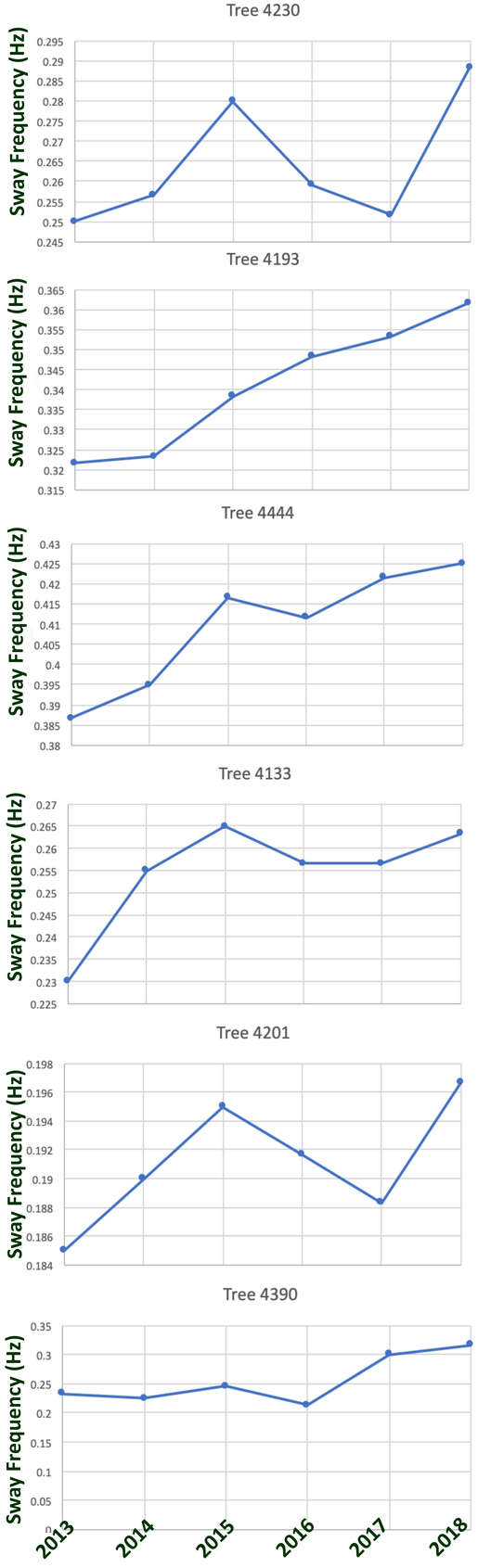
Tree# 4201
Mockernut hickory
Diameter: 44cm
Height: 28m
Crown radius: 6m
Co-dominant in canopy
Interior in stand

Tree# 4390
Red oak
Diameter: 68cm
Height: 31m
Crown radius: 5m
Dominant in canopy
Edge of stand

Study begins (Storrs site initiated in Sept., 2012) — **"Stormwise" Forest Management treatment implemented (Fall, 2013)** — **4 years of southern New England weather occur...**



Change in frequency 2013-2018



Sway frequency:
hypothesized to rise in years after treatment as trees become more wind firm through the process of Thigmomorphogenesis -
developing wind firm characteristics in response to increased wind-induced movement.

Sway frequency is not effected by the strength of the wind but is a product of tree size, shape and characteristics of woody material, as well as presence/absence of leaves and freezing temperatures.

Preliminary observations:
Sway frequencies of trees appear to be increasing over time in general.

Sway amplitude:
Expected to increase immediately following treatment, due to increased wind intensity within the stand.
Expected to decrease over time from initial adjustment as trees adapt to a new wind regime.

Preliminary observations:
Area covered by sway print appears diminished for most trees in the most recent years.

This research is ongoing.
Please see this paper for a detailed description of the methodology:

Bunce, Amanda, et al. "Determinants of tree sway frequency in temperate deciduous forests of the Northeast United States." *Agricultural and forest meteorology* 266 (2019): 87-96.

Please contact me with any questions, comments or ideas. Thank you!

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