

Lake States Fire Science Consortium

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The potential of Spring Dip timing in red pine and jack pine foliage moisture changes on fire behavior and spread

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The “Spring Dip”, or seasonal reduction of foliage moisture, has been observed in pine trees across the Great Lakes region since the 1960s. In a research study conducted by Jolly et al (2016), the authors sought to measure the changes in leaf chemistry and moisture during the dip and use those data to model fire behavior.

To determine the changes in foliar chemical and physical composition, the researchers collected pine needles from red pine and jack pine across northern Adams County in central Wisconsin, USA. The samples were collected weekly from April to September 2013, and monthly from October 2013 to March 2014. The researchers measured the chemical composition of fats, proteins, and fiber/non-fiber content of the foliage in addition to bulk density and dry mass of the needles. They then tested the ignitability of the foliage in an open-flame burner to measure the time required for the needles to ignite under fire conditions. These data were then input into the HIGRAD/FIRETEC fire behavior model to test whether the measured changes in needle moisture and chemistry would change fire behavior under several wind conditions.

From these analyses, they found that foliar moisture began to drop in April, and continued to drop through the summer until May (for jack pine) and June (for red pine). Foliar moisture recovered completely by August in both species. Fire behavior modeling showed that fires occurring during the spring dip would exhibit a much higher rate of spread (up to 12m/min) in low to moderate wind conditions compared to fires during tree dormancy. As wind speeds increased however, the difference between dormant season fires and spring dip fires decreased. Total area burned was consistently higher during spring dip conditions. The fire model results showed that fires occurring during the spring dip will spread more rapidly, and will exhibit increased lateral spread relative to fires in non-dip conditions.



MANAGEMENT IMPLICATIONS

1. Spring dip conditions in pine forests last approximately from April through August in central Wisconsin, with minimum foliar moisture reached in May for jack pine and June for red pine.
2. Increased bulk density of pine needles in red pine and jack pine during the spring dip increase their flammability.
3. Fires during the spring dip may exhibit increased lateral spread along the head of the fire, which could require additional consideration during fire suppression.

Want to learn more?

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Jolly, W. M., Hintz, J., Linn, R. L., Kropp, R. C., Conrad, E. T., Parsons, R. A., & Winterkamp, J. (2016). Seasonal variations in red pine (*Pinus resinosa*) and jack pine (*Pinus banksiana*) foliar physio-chemistry and their potential influence on stand-scale wildland fire behavior. *Forest Ecology and Management*, 373, 167-178.

Research Brief for Resource Managers

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