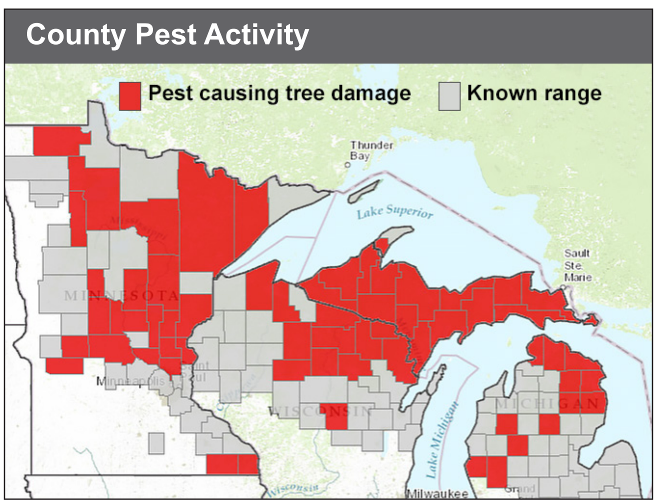
Research in Progress

Forest Products Laboratory

New Technologies for Ensuring Best Use of Salvaged Beetle-Killed Trees

Dead standing trees resulting from insect outbreaks are thought to pose wildfire and personal safety hazards. In the Upper Midwest region of the United States, cyclic spruce budworm outbreaks occur every 30 to 50 years and last approximately 10 years. Since 2010, this region has experienced increased spruce budworm activity and associated tree mortality. Dead standing trees may be salvaged and utilized for lumber, pulp and paper, or bioenergy, depending on their wood quality. However, due to concerns regarding wood quality of dead and dying standing trees in affected stands, salvaged trees tend to be utilized for low-value products that do not require strict wood quality standards. This project will demonstrate several new technologies to test the wood quality of dead and dying standing trees for the production of value-added engineered wood products. and evaluate whether this timber may be utilized to construct higher-value engineered wood products.



Reported spruce budworm impacts in 2014 (USDA Forest Service, Forest Health Protection and its partners 2015).

Background

Spruce budworm mortality, Chequamegon–Nicolet National Forest, Summer 2014 (Steven Katovich, USDA Forest Service, Bugwood.org).

Because dead standing trees resulting from insect outbreaks pose a hazard, forest managers are interested in promoting the removal of many of these trees, particularly in areas with high recreation values and near the wildland–urban interface. Utilizing wood salvaged after an insect outbreak is challenging because the quality of the wood is highly variable and often unknown. Forest stands tend to die gradually during outbreaks, with trees within a stand dying at different times. The wood deteriorates slowly over time. Variations in time of death and rate of deterioration result in great variation in wood quality of standing dead timber.

If forest managers were able to accurately measure the quality of wood in individual standing trees during salvage operations, they would be able to sort the logs for sale by quality. Logs from trees with higher wood quality could be separated and sold at higher values. Logs from trees with lower wood quality could be sold for pulp and paper or bioenergy applications, and trees that do not reach minimum standards for utilization would be left in the forest as dead standing snags or coarse woody debris. By optimizing returned value

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from salvaged wood, forest managers could maximize profits and have greater incentive to utilize this biomass.

Objective

The overall objective of this project is to demonstrate new technologies to test the wood quality of dead and dying standing trees resulting from spruce-budworm activity for the production of a value-added engineered wood product: cross-laminated timber (CLT) panels. The specific objectives are to (1) quantify the range of wood quality of dead standing snags after an insect outbreak, (2) investigate whether visual assessment of dead standing snags accurately describes measured wood quality, (3) determine how wood quality of dead standing snags relates to wood quality of logs and sawn lumber, and (4) investigate whether CLT panels fabricated from salvaged dead standing snags after an insect outbreak may reach standards required for building codes.

Approach

Approximately 120 dead and dying trees will be selected from each of at least three spruce–fir forest stands undergoing salvage or pre-salvage treatments in the face of the current spruce-budworm outbreak in the Upper Midwest. Each tree will be assessed visually using standard protocols, and wood quality will be measured using three nondestructive techniques: (1) longitudinal acoustic waves, (2) single-path stress wave timing, and (3) resistance drilling. Following field assessment, the trees will be salvaged and sorted into high-, moderate-, and low-quality classes based on measured wood quality. Individual logs will be tested using the same nondestructive methods and then milled into 2 by 4 dimensional lumber. Lumber will be kiln dried, surfaced, and graded. Thirty-six CLT panels (2 by 8 ft, three-ply) will be produced from the salvaged lumber, four panels from each of the three tree quality classes from each of the three stands. Each CLT panel will be tested at FPL using standard qualification procedures to evaluate the structural performance of the panels and to ensure that they reach minimum standards for utilization. ANOVA will be used to contrast the wood quality of the CLT panels produced from high, moderate, and low wood quality trees.

Expected Outcomes

The successful completion of this project will facilitate future implementation of new wood quality assessment technologies and encourage the utilization of salvaged spruce–fir across the region.

Timeline

Forest stands will be selected and tested in fall 2016 and spring 2017. Tree salvage, log measurements, mill process, and lumber evaluation and grading will be completed by August 2017. CLT panels will be fabricated and tested by spring 2018. Data will be consolidated and analyzed by fall 2018. The final report will be submitted by August 2019.

Cooperators

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