Optimal Timber Truck Routing Under Coordination in the Pacific Northwest (Summary)

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This is a summary of Optimal Timber Truck Routing Under Coordination in the Pacific Northwest by Eric Jessup, Jake Wagner, and Timur Dincer.[1] This research and analysis received funding from USDA's Agricultural Marketing Service (AMS) through cooperative agreement number 19-TMTSD-WA-0009. The opinions and conclusions expressed are the authors' and do not necessarily reflect the views of USDA or the Agricultural Marketing Service. The full report is available online at http://ses.wsu.edu/wp-content/uploads/2022/08/Optimal-timber-truck-routing-under-coordination-in-the-PNW.pdf .

WHAT IS THE ISSUE?

The forest products industry contributes significantly to the economic welfare of large portions of rural America. This is especially true in places endowed with the natural resources necessary to produce timber. The Pacific Northwest (PNW) region has large areas that produce timber, both on private and public lands. Currently, transporting logs from the forest to sawmills is a very costly and inefficient activity. The log transport process significantly reduces the returns to log truck owners/operators, hampers efficient operation of sawmills, and ultimately reduces the market for U.S. timber products. The process is most inefficient where sawmills are sparsely situated across vast, remote forests with limited road and highway access, as is the case in PNW.[2]

Part of the challenge is the fragmented, independent nature of small, owner-operator, log transportation businesses. In most cases, these carriers contract with logging companies to transport logs from harvesting locations to specific mill locations. Typically, carriers will travel with empty trailers from their homes to the forest. There, their truck is loaded and then sent to the mill for delivery. After delivery, carriers typically return to the same forest to pick up another load and deliver it to the mill. They repeat this cycle for as many trips as can be completed in a day, before returning home with an empty trailer.

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2 A sparse road network serves as an additional barrier to identifying efficient backhaul opportunities.

The high share of empty backhaul miles in these trips is inefficient, not only because they are empty, but also because they limit the number of trips that can be completed daily—and thus limit revenue earned. These inefficiencies in transportation stem from a lack of information and a lack of coordination. Log-transport carriers do not know the optimal routes they should drive to maximize use of their time and trucks. Such routes require coordination, so the fragmentation within forests and between forests and mills prevents such routes from being driven.

This study identifies the value of an information system that facilitates coordinated optimal routing, within the PNW timber industry.

WHAT DID THE STUDY FIND?

The researchers evaluated the net benefits of an information system that facilitates optimal coordinated routing. The evaluation is done by comparing the costs, both private and public, of timber transportation under two scenarios—status quo (no coordinated routing) and coordinated routing. Under the status quo roundtrip routing scenario, roundtrip routes averaged 33.6 miles in length, with annual flows on each route averaging 97,984 cubic meters (2,500 truckloads). Because of the roundtrip routing constraint, 50 percent of all miles traveled were empty backhaul miles.

Under the coordinated routing scenario, coordinated routes averaged 32.5 miles in length (haul + backhaul), with annual flows on each route averaging 78,010 cubic meters (1,950 truckloads). Without the roundtrip routing constraint, the share of empty backhaul miles were reduced from 50 percent to 43 percent, reflecting gain in efficiency. Annual total public and private efficiency gains from coordinated routing were estimated to be $6.8 million. This efficiency gain results in a $5.6 million (6%) cost savings/year and a 7% reduction in annual greenhouse gas emissions due to the decreased mileage travelled (valued at $656,628/year). Reduced mileage also results in less wear and tear on the roadways, generating approximately $0.12 per mile saved (FHWA, 2000), for a total of $505,099 annually. Annual total costs were estimated at less than $6.8 million annually (or $5.2 million if we consider only private investments). The results indicated adoption of coordinated routing would have a positive return on investment within the Pacific Northwest. However, identifying coordinating routing opportunities is often difficult as opportunities are not always obvious. Therefore, investment in a coordinated routing information system may be beneficial as a next step.

HOW WAS THE STUDY CONDUCTED?

The researchers developed a transportation optimization model to identify the most efficient routing of timber from each forest plot to each mill in PNW. In this way, they simulated an environment where information associated with truck transportation services, log harvest, and mill operations was shared across a platform. The exchange of information was used to increase coordination and maximize operations regionwide. The model treated mill demands as exogenous outputs from a Land Use and Resource Allocation (LURA) model (Latta et al., 2018). Given timber supply at each forest plot and timber demand at each mill, the model identified the least-cost routes to meet mill demand, without exceeding forest supply/harvest constraints. The model was solved under two operational scenarios: a status quo scenario under which all trips were roundtrips with empty backhauls; and an optimal scenario which flexibly allowed for coordinated routing and non-empty backhauls. The difference in costs and efficiency between the status quo scenario and the optimal routing scenario was used to estimate the value of investing in information technology that would achieve improved product flow and efficiency through coordinated, optimal routing.

PREFERRED CITATION

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