Improving Large Trailer Access For Biomass Recovery in Steep Terrain

Bryent Daugherty and John Sessions
Department of Forest Engineering, Resources, and Management, Oregon State University, Corvallis, Oregon, USA
bryent.daugherty@oregonstate.edu, john.sessions@oregonstate.edu

OSU Oregon State UNIVERSITY
College of Forestry

Introduction

Over 40 million dry metric tons of forest harvest residues are produced every year in the United States (US Dept. of Energy 2011); however, between 30-40 % of the private and state forest lands in the Pacific Northwest are in steep terrain making it difficult and costly to obtain. To increase the residue density and to minimize rehandling of biomass, comminution, usually by grinding, takes place at the landing (Fig 1.)

FIGURE 1. – Typical operation grinding at the landing on Olympic Peninsula.

In general, the larger the chip van that can be pulled to the site, the lower the transport cost. Challenges to large trailer access include tight horizontal curves, steep grades, narrow roads, short vertical curves, and lack of turnarounds. Large chip vans are usually 5th wheel trailers. Various designs are used to improve trailer mobility including sliding axle trailers, stinger-steered trailers (Fig 2), and more recently self-steered trailers (Fig 6). All wheel drive truck tractors have been used to increase gradeability of chip vans (Fig 6).

FIGURE 2. – A stinger-steered chip van (left) and sliding axle 5th wheel chip van (right).

As much as 75% of the recoverable biomass is estimated to require movement to a central landing before comminution. Various transportation systems have been developed to improve grinder utilization and trailer accessibility (Fig 3,4). As an alternative to large trailer access, some contractors use bin trucks, hook-lift trucks, or converted dump trucks to move forest residues to a central site for grinding.

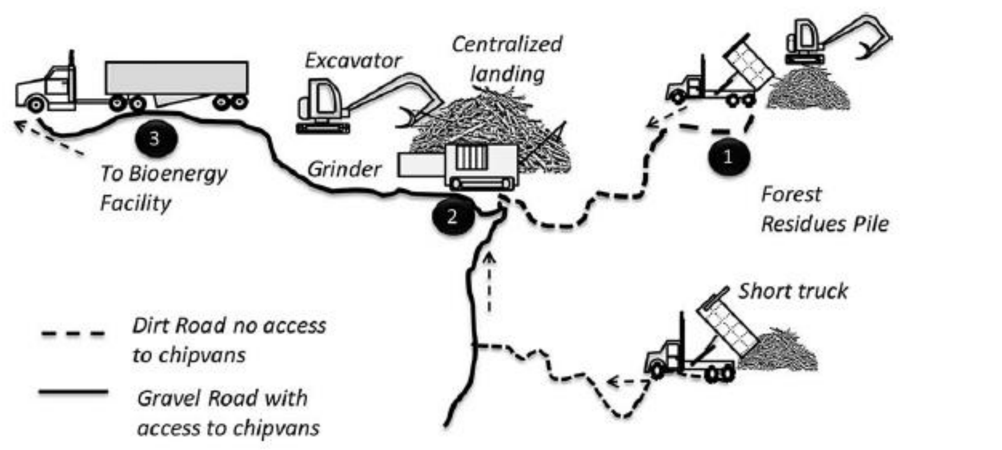

FIGURE 3. – A model depicting the use of a stationary grinder at a centralized yard using multiple short trucks (30-50 m³) to transport the forest residue. The numbers in the black circles represent each stage of the process.

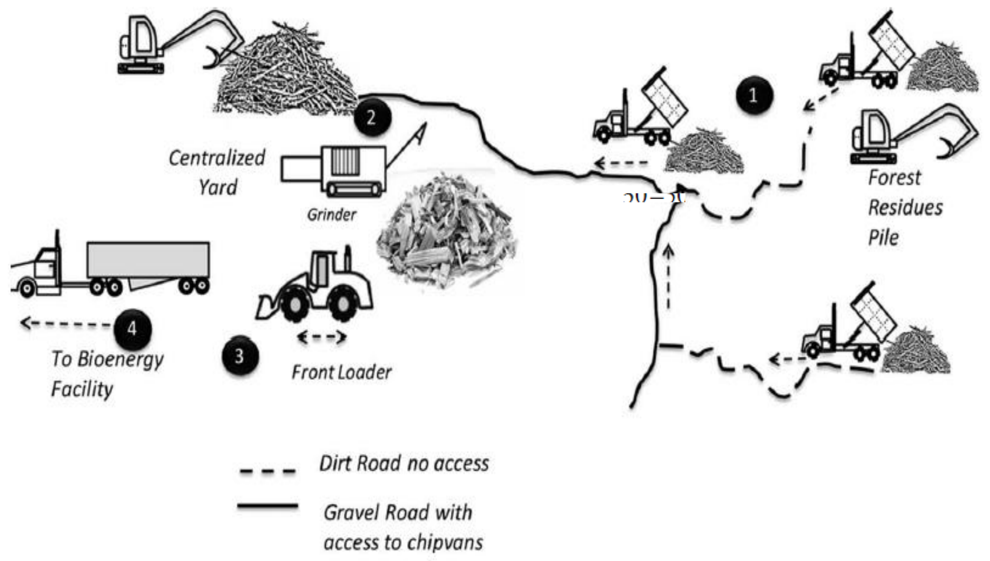

FIGURE 4. – A model depicting the use of a centralized yard outside of the harvest unit.

FIGURE 6. – A 6x6 truck tractor (left) and a self-steering trailer (right).

Objectives

In 2010 Hermann Brothers Logging, Port Angeles, WA worked with Western Trailers, Boise, ID to develop a self-steered trailer (Fig 6,7) to increase large trailer access for steep areas of the Olympic Peninsula, WA. Our main objective is to document the mobility of self-steered trailers in steep terrain. The test trailer will be the 48-ft drop center trailer developed by Hermann Brothers. We will compare that trailer to standard trailers with and without sliding axles provided by another local contractor, Bill Quiqq (Grays Harbor, WA).

FIGURE 7. A 48-ft drop center trailer with self-steering trailer on a narrow forest road being pulled by 6x6 truck tractor.

Methods

- Document the conditions under which self-steering and sliding-axle trailers are being used to verify turn-around requirements, gradeability, and off-tracking.
- Develop a sampling plan to understand what proportion of landings could be accessed by standard trailers.
- Explore material handling strategies at shorter and longer distances to haul ground and unground residues by standard trailer with and without intermediate transfer and processing (if needed) and to compare them with hauling ground residues with self-steered trailers with and without intermediate transfer to longer distance transport by standard truck/trailers.

Anticipated Outputs

We will develop an operating cost model for self-steering and sliding-axle trailer configurations to compare capital and operating costs and productivity. We will use the RENO model developed by others on the NARA project to compare strategies.

NARA
Northwest Advanced Renewables Alliance

NARA is led by Washington State University and supported by the Agriculture and Food Research Initiative Competitive Grant no. 2011-68005-30416 from the USDA National Institute of Food and Agriculture.

USDA NIFA