Multi-pass vs. aggregated harvest systems: Comparing forestry road networks

Temporary forestry road effects #2

Forest harvest systems influence temporary or non-permanent forestry road networks in many ways. This can include changes to how many roads are built, how long they are active and how quickly they can be reclaimed. In Alberta, conventional multi-pass or "business-as-usual" harvesting typically involves multiple entries into harvest areas over several decades, contributing to prolonged road use and persistent access.

In contrast, aggregated harvest systems concentrate harvest into larger harvest areas completed in a single pass over a specified time period, reducing how often roads are reused and how widely they extend across the landscape over time. Understanding how these two systems compare is essential for refining long-term road planning approaches that support better outcomes for caribou.[1] **While aggregated harvesting may reduce the number and distribution of temporary roads and support future caribou habitat continuity, it can also require building stronger and longer main haul roads up front.** These and other factors are explored through this ARCKP technical note.

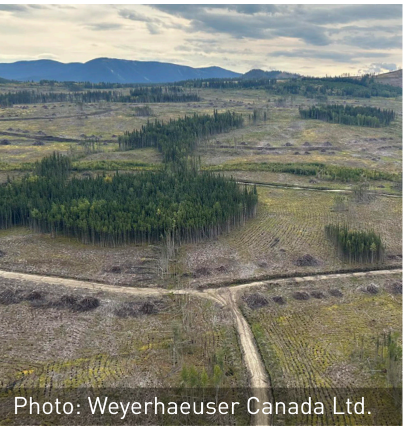


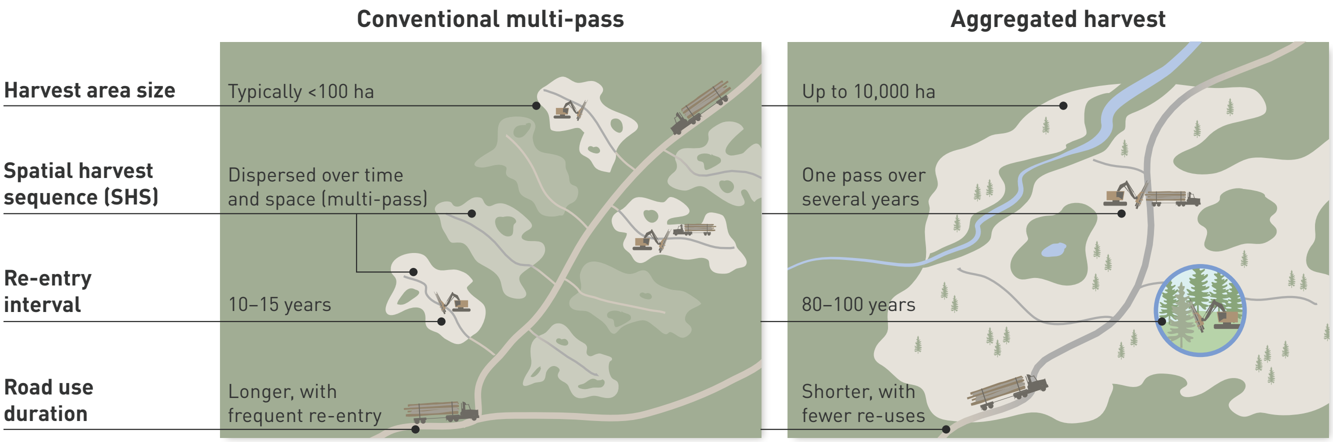
Photo: Weyerhaeuser Canada Ltd.

Highlights

- Temporary road types and general construction practices are not expected to differ between conventional multi-pass harvest and aggregated harvest systems.
- Aggregated harvest may reduce the number, length and duration of temporary roads overall. However, concentrated use of main access roads may require more robust construction, potentially requiring more thoughtful reclamation efforts.
- Improved road planning, deactivation and reforestation practices apply across both harvest systems.
- Modeling suggests aggregated harvest may offer some road reduction benefits.

Conventional multi-pass vs aggregated harvest systems

The key differences between conventional harvest and aggregated harvest systems lies in how harvest is spaced over time and across the landscape, influencing harvest area size, road networks and re-entry intervals.



[1] The findings reported in this note are based on literature review and interviews with forest industry staff.

Conventional multi-pass harvest

Conventional multi-pass harvesting disperses activity across the landscape and over time. Smaller harvest areas (c. <100 ha) are harvested in multiple passes, with each entry targeting new areas separated by unharvested forest. These adjacent unharvested areas are typically accessed 10 to 15 years later, resulting in a staggered harvest sequence across planning units.

Because harvest is spread out across different areas and happens over many years, roads are used repeatedly over decades to access different parts of the landscape. Roads built during initial entries are often left open between passes to avoid redundant reclamation, especially where re-entry is expected within a decade.

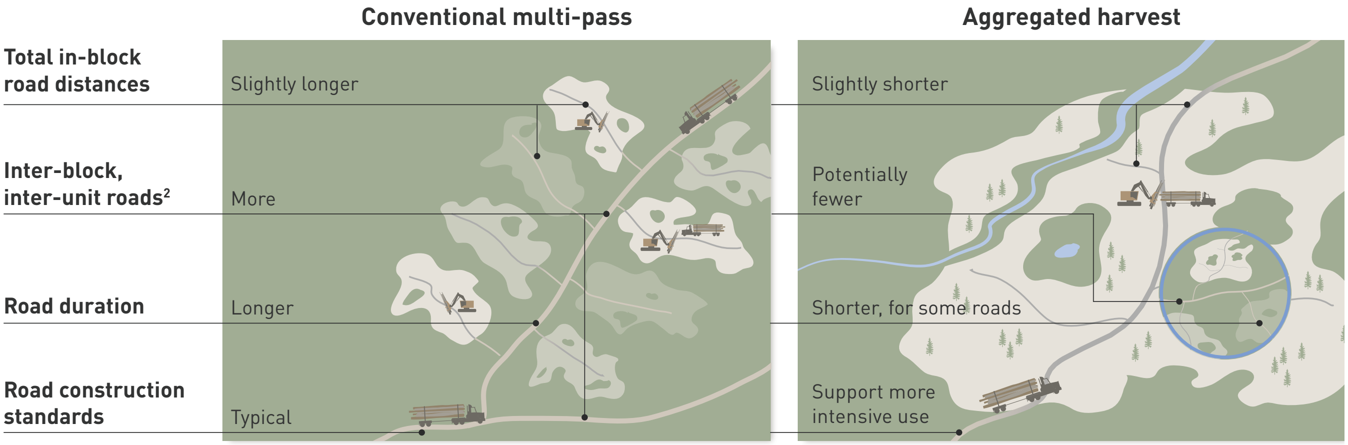
Aggregated harvest

Aggregated harvest systems consolidate multiple adjacent harvest areas into larger harvest areas (e.g. >10,000 ha), completed in a single pass over approximately 10 years. Unlike conventional harvest, these systems avoid re-entering the same planning unit for 80 to 100 years, significantly reducing how often and how widely roads are used. By concentrating harvest within one timing window, fewer roads are required over time, and the surrounding forest remains undisturbed for decades until regrowth matures. Although total road length may be lower, main access roads may need to be constructed to higher standards to support more intense short-term use. These roads may require greater reclamation efforts with increased recovery time.

How road networks differ between harvest systems

While the general types of roads used may not differ between aggregated and conventional harvest systems, aggregated harvest creates different road network patterns – often with fewer, but more intensively used, main access roads. As a result, some of these roads may require more robust construction and thoughtful reforestation to address increased use. However, improved road practices, including better reclamation/reforestation planning, apply to both harvest systems.

The following considerations highlight how these differences in road use may play out across a harvest landscape:



[2] See note #1 in this series for non-permanent road types

What modelling tells us about aggregated harvest road reductions

In a previous project funded by the ARCKP, Purdy et al. (2022) modeled several aggregated harvest scenarios across three Alberta caribou planning sub-regions. The results suggest that **aggregated harvest has the potential to reduce temporary road requirements compared to conventional harvest systems.** However, outcomes vary depending on forest productivity and landscape configuration. While the study concluded that aggregated harvest would generally require fewer access roads than conventional harvest, the modelling was limited to persistent class 3 roads and did not include temporary class 4 and 5 roads.

Key findings:

- Aggregated harvest has the potential to reduce inter-planning and inter-block roads of class 3 to class 5 (non-permanent) over the long term.
- Because re-entry for harvest is not expected for 80-100 years, many temporary roads can be reclaimed sooner under aggregated harvest.
- Aggregated harvest concentrates activity, increasing short-term road use intensity in a smaller area while reducing long-term disturbance across the landscape.
- Roads remained on the landscape in the model for 10 years post-construction and were considered a caribou disturbance for 40 years after reclamation.
- By the end of the 100-year modeling period, differences in road metrics (e.g., building, maintenance, usage) between conventional and aggregated harvest were minimal – except for a small reduction in total log haul road distance.

Aggregated harvest may reduce temporary road use over time, though the overall effect on landscape disturbance may be small relative to the total linear disturbance footprint in Alberta.


Photo: AFPA

Aggregated harvest system considerations

Only minor operational changes and minimal cost increases have been observed when planning and implementing aggregated harvest systems to date (aggregated harvest has not yet been widely implemented in Alberta). Other key considerations include:

- The need for strategic and economic road use planning due to larger planning units, long (100-year) harvest horizons, and no return access once roads are reclaimed.
- Potential increases in logistical complexity and limited wildfire response options. With fewer roads remaining on the landscape post-harvest, access for wildfire suppression or other emergency response may be more limited.
- This report's recommendations apply equally to both harvest systems; therefore, aggregated harvest does not require additional changes to current road planning, design, construction, or reclamation practices.
- Few differences in non-permanent road requirements compared to conventional systems.

Practical Implications

While aggregated harvest may contribute to reduced temporary road use in the long-term, its effectiveness for supporting caribou recovery depends on how roads are planned, built and reclaimed. To help align operational planning with broader caribou habitat objectives, consider:

- **Implementing aggregated harvest** to reduce overall temporary road footprint, but weigh this against potential need for higher construction standards on main access roads and increased long-term forest management planning.
- **Applying best road construction and reclamation practices** consistently, regardless of harvest system type (see Notes #1 and #3 in this series).
- **Accounting for existing infrastructure when planning harvest operations**. Areas with established road networks may require minimal temporary roads, while remote areas will require extensive temporary roads regardless of harvest system.

Future considerations

- **Model differences** in temporary road footprint between aggregated and multi-pass harvest scenarios.
- **Integrate model results** into caribou response equations to assess the relative effects of temporary forest roads within the broader linear disturbance footprint.
- **Use this analysis** to inform prioritization of road reclamation and habitat restoration efforts.


Photo: Weyerhaeuser Canada

Further reading

Purdy, L., Bouchie, C. and Christian, B. 2022. Exploring the implications of aggregated harvest in woodland caribou ranges. Report produced by Forcorp for the Alberta Regional Caribou Knowledge Partnership. Retrieved from: https://arckp.ca/data/ARCKP_Harvest_Patterns_Two-Pager_20220525.pdf

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