GreenLane
– fast-tracking value and resilience for industrial wood supply

GreenLane RBC – developing digital solutions for monitoring forest road availability in real-time

How to monitor forest road availability with existing digital data and infrastructure?

In the Nordic countries, maintaining av even year-round wood supply requires utilizing both winter frost and summer dry periods to gain access to areas of low bearing capacity. Global warming has therefore required re-scheduling of harvesting and transport from winter to summer conditions.

The seasonal availability of forest roads in non-industrial forests is often unclassified, and transport planning relies on the local knowledge of managers and haulers to coordinate transport with suitable weather conditions. This study used PapiNet digital transport messaging to capture these trends. Weekly road use was tracked in two regions (coastal and interior Norway) over three climate zones per region. 200 000 transport messages were joined by transport date and landing coordinates to digital road network data, surrounding quaternary surface deposits and weekly weather (temperature, precipitation and snow depth).

Multivariate principle component analysis (PCA) was used to link weekly transport volumes, road characteristics and weather conditions. Variation in weekly transport pace was linked to six surface deposit types and their associated texture and water infiltration characteristics. Climate zones with low winter temperatures and deep snowpacks were associated with the longest duration of reduced transport during the spring thaw, as well as high transport volumes from areas of glacio-fluvial deposits (coarse texture). Variations in transport volumes showed a general negative correlation of transport pace between areas of coarse-texture (glacio-fluvial sediments/moraines) and areas of fine-texture soils (marine or fjord-sediments). Periods of reduced precipitation (e.g. pre-summer drought) were correlated with *increased transport* from areas with thin moraines and marine sediments (low infiltration capacity) and *reduced transport* from thick moraines and fluvial deposits (high infiltration capacity). Field measurements of road e-module and rutting confirmed the varying road bearing capacity (MPa) for respective deposit types, as well as key road construction materials.

This approach captured the same rules-of-thumb used by experienced managers/haulers to judge the relative bearing capacity of unclassified forest roads. Weekly allocations of transport capacity could be characterized in two ways; i) *by necessity*, when the road type was the only feasible option during difficult weather conditions, and ii) *by opportunity*, when the road type was an acceptable option during better weather conditions. The patterns of road utilization varied between the coast (wet, warm) and interior (dry, cold) due to the respective distributions of volumes between surface deposit types.

Monitoring of digital PapiNet transport messaging within existing digital infrastructures enables real-time tracking of road use and their inferred availability. Together with knowledge of key road characteristic (bearing layer construction material) this approach enables a rough but dynamic classification of forest roads' relative bearing capacity (RBC) during changing weather conditions.

Dag Fjeld,
Jan Bjerketvedt,
Martin Braathen

The goal of Forest value GreenLane is to develop virtual supply chain laboratory environments enabling value-tracking and interactive testing of harvesting and transport responses to challenging climate scenarios. Its focus is on implementing weather-driven models for wood quality and availability.