Trafficability model testing

Shaun Mochan, **Jari Ala-Ilomaki** and **Ian Stewart** report on a project evaluating ground damage of forest operations

The aim of the ongoing EFFORTE project is to establish a basis and to develop methodologies to predict trafficability of given forest stands or perennial extraction routes prior to forest operations in the most common sensitive situations. The project's role is to evaluate the soil compaction risk of forest operations by considering soil type and conditions, machinery properties, forest stand structures and climate.

The recommendations that are the ultimate output and deliverables to the forest industry are based on predictions of soil deformation of forest operations under given soil conditions, estimates of soil recovery potential under given climate and forest stands including mechanical stresses induced by forest machines.

Model testing in Scotland was completed in June 2018 at a location in Aberdeenshire. The methodology used to test the Finnish model is described right. Elements such as water maps have not been added at this time to better understand the full complexity of harvesting and silviculture in relation to soil compaction and damage during and after harvesting.

The wheeling test enabled us to initially test the soil structure with the assistance of Dr. Dave Braidwood at North highland College, UHI. Soil sampling within the pre-prepared tracked area shown below. A 40m long route was marked out to give precise indications of where the wheels on the harvester and forwarder would fall given the exact dimensions of the wheels at 710mm.

Initial conclusions

The initial conclusions to the project testing indicate a successful comparison with soil type and machine damage. Integrated databases such as the ones SODRA in Sweden use for each of their contract machines allows harvester and forwarder operators to fully understand the best pathway to harvest and retrieve wood. These techniques are also allowing future silvicultural practices to be better understood for future management regimes.

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www.luke.fi/efforte

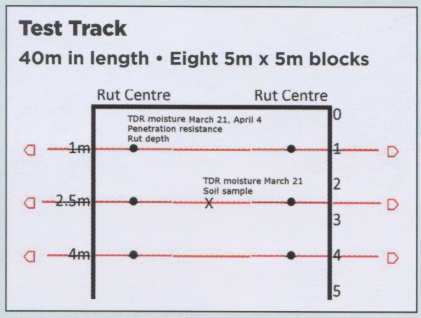
FTN WEB RESOURCES

Download a presentation including all graphs of the wheeling tests
www.confor.org.uk/ftnweb

METHODOLOGY

1. Soil samples and soil moisture were taken to understand the parameters of the soil structure. Penetration tests (TDR) were also undertaken within each 5mx5m block created to comprehensively study each area of the test site. These TDR were taken twice, once before the test and after the initial harvester had made one pass along the length of the track.

2. Bulk density and grain size was measured to map the structure of the soil at each location, 1, 2.5 and 4m within each 5m block.
The project, courtesy of James jones and Sons Ltd, supplied a John Deere harvester 1270E, 8-wheeled with no chains or tracks and weighing 24tonnes and a John Deere forwarder 1110G 8-wheeled with no chain and tracks.



3. The harvester made one pass with the forwarder making five passes loaded with various tonnages:
• 1st pass: 29.63t • 2nd pass: 28.33t • 3rd pass: 28.03t
• 4th pass: 31.13t • 5th pass: 29.43t
Both machines were travelling on Nokian Forest King TRS 2 710/45-26.5 with inflation pressure 552 kPa.

4. We measured the rut depth using two methods, a simple wooden constructed hurdle placed over each wheel mark after each pass to measure the depth marking each specific point to enable exact repeatability. We also used optical measurement to build a picture of the slope and rut depths after each pass.

The images were taken from east and west side at same location point after five forwarder passes.

EFFORTE