

A QGIS based workflow for optimized cable road layout planning

Cable-based technologies have been a backbone for harvesting on steep slopes. The planning of a cable road is a complex task. It essentially comprises the definition of the start and end points of a cable road, as well as the intermediate supports. It must be ensured that the permissible forces (in particular skyline tensile forces) are not exceeded, that there is a sufficient clearance between the load path and the ground, that suitable anchor trees are found and that at the same time the number of intermediate supports is minimised as far as possible. On the other hand, for ergonomic and silvicultural reasons (work safety, damages to the forest), the suspension rope should be as high as possible. In practice, the search for a solution is often iterative; especially with long lines, several attempts may be necessary until a good line is found. The presented QGIS plugin searches automatically for the optimal cable road layout, so the planning process can be considerably simplified and obtained solutions are more cost-efficient.

The plugin is designed for Central European conditions and assumes a standing skyline (fixed anchored skyline at both ends). For the calculation of the mechanical properties of the skyline a close to catenary method is used (Zweifel 1960). When testing the feasibility of the cable line, care is taken that 1) the maximum permissible stresses in the skyline are not exceeded, 2) there is a minimum distance between the load path and the ground and 3) when using a gravitational system, there is a minimum inclination in the load path. The newly developed method calculates the load path curve and the forces occurring in it more accurately than other tools available on the market. We further present a method to identify potential support and anchor trees directly from remote sensing data, which is as well integrated in the plugin. This ensures that there are effectively trees at the proposed intermediate positions and that the solution can be implemented in practice. Results of tests which will be carried out in forest enterprises in Austria and Switzerland will also be discussed.