

Terra Incognita - Beneath the Canopy

Despite living in an age of Google Maps and GPS, Sweden's terrain is surprisingly poorly mapped, a problem with real consequences for sustainable forest management. When planners work with incomplete information, forestry operations may damage unmarked wet areas crucial for water quality, cultural heritage sites risk destruction, streams go unnoticed, and unknown road culverts are washed away. This matters more than ever as forests face mounting demands for timber, energy, carbon storage, and biodiversity conservation. The breakthrough comes from airborne laser scanning, which sends millions of laser pulses through the forest canopy to reveal the ground beneath in remarkable three-dimensional detail. Suddenly, subtle depressions indicating cultural remains, meandering streams, and wetland patterns become visible. Features that traditional mapping methods and satellites simply cannot detect through dense vegetation.

My research uses machine learning to automatically recognise and map these landscape features from LiDAR data across millions of hectares, far more than human experts could analyse manually within a hundred years. By training models on thousands of examples, they learn to identify the characteristic patterns of streams, wetlands, cultural remains, and terrain features with both speed and consistency. But creating better maps is only valuable if they're used. A substantial part of my work involves bridging the gap between research and practice: working directly with governmental agencies, forestry companies, and municipalities to integrate these mapping methods into their decision-making. The potential extends beyond forestry; transportation infrastructure, such as roads and railroads, can be better protected from extreme downpours with predictive modelling of road culverts and shallow groundwater. As LiDAR technology becomes more accessible and machine learning methods improve, we're finally able to see our forest landscapes as they truly are, enabling us to manage them more wisely for future generations.