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## Detection of drainage ditches using high-resolution LIDAR data in the Swedish forest

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Drainage ditches are common in boreal forests and provide better soil aeration and tree growth by draining the wet soils. Peatland drainage in the last century has created about 1 million km of artificial streams in Sweden, making it one of the most widespread human-induced environmental disturbances. This extensive use of ditches over a long period resulted in a major shift in forest hydrology and impacted the ecosystem functions. Therefore, there is a pressing need for an accurate database of forest ditches so that sustainable management can be practiced to improve the overall functioning of the forest ecosystem. Comparisons with national field datasets show that existing maps only show a small fraction (<10%) of the ditches across the country. To address this knowledge gap, we applied AI methods on high-resolution (1 m) LIDAR data to map drainage ditches in a subset of the Swedish forest. We developed a suite of topographic indices and analyzed those with machine learning and deep learning algorithms to perform automatic ditch detection. Both models produced reasonably accurate results and a substantial improvement over the existing maps in terms of ditch detection. The impoundment index and high pass medium filter from the digital elevation model were among the top predictors of drainage ditches. The study introduced a new avenue for accurate detection of forest ditches across the whole country. Our AI-generated maps of ditches provide effective tools for the restoration of degraded land and support ditch cleaning operations to increase forest growth.