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Detection of hidden pre-industrial charcoal kilns by high-resolution LIDAR

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Over the last decade, systematic archaeological excavations in the open-cast mine Jänschwalde (Brandenburg, Germany) have revealed one of the largest, archaeologically excavated pre-industrial charcoal production area in Central Europe. Many of the charcoal kiln relics are easy to detect by survey as they lie close to the surface and charcoal pieces hint on their existence. In the excavations the remains of the charcoal kilns are distinct, black circles in the light-coloured sands.

To date, in the former Königlich-Taubendorfer Forst c. 800 remains of charcoal hearths have been excavated and documented by archaeologists in an area of about 20 km2. Further c. 300 charcoal hearths are prospected by survey. Unfortunately, the spatial information about the charcoal kiln sites in Lower Lusatia (and elsewhere) is incomplete since we only have data from the archaeological excavation and prospection in the directly affected mining district. To fill this gap, we decided to test the applicability of Airborne Laser Scanning (ALS) data for charcoal kiln prospection.

The particularly improved quality of the recent high-resolution light detection and ranging (LIDAR) data enabled the computer-aided detection of charcoal kilns and their evaluation using a geographical information system (GIS). Following data processing, the charcoal kilns are visible as buttons-like shapes in the shaded-relief maps (SRM). The characteristic shapes arise because the kiln plates are some centimetres to decimetres higher than the ditches around them. Numerous ground checks confirmed the applicability of the prospection by ALS data. But, we also assume that c. 10% of the charcoal kilns remain unidentified.

A 26.6 km2 study area in the Tauerscher Forst, a forest about 10 km northwest of the open-cast mine Jänschwalde, was selected for prospection using a 1 m resolution ALS data set from the year 2011. Today, the area is forested with pine, and no archaeological excavation has been carried out so far. In the study area 2300 charcoal kiln sites can be clearly identified and 261 more features are ambiguous. Together with the excavated and prospected sites in the Königlich-Taubendorfer Forst we now have proof of at least 3400 circular charcoal kilns with diameters up to 18 metres. However, the study area represents only a very small part of Lower Lusatia and an even smaller portion of the North German Lowland – both areas of potential charcoal kiln findings. We thus conclude that historical charcoal production sites are underestimated components of modern landscapes and that most of these sites are hidden legacies which are not detected so far due to destruction and/or the lack of high-resolution Digital Elevation Models (DEM).