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| **Automatic detection and mapping of lying deadwood in Nature Reserve Lipowka (Niepolomice Primeval Forest, Poland) using dense ALS point clouds and AI laslogic approach in LAStools (rapidlasso).** |
| **Introduction/Aim:**  The role of dead wood in tree stands cannot be overestimated, as it plays a very important role in increasing biodiversity indicators, being the habitat of many species. Moreover, dead wood is an extremely important link in the circulation of matter in the forest ecosystem, increasing of water retention, maintaining soil moisture. In most cases, it is a great solution of CO2 sequestration and carbon accumulation, although climate changes may reverse this. The accumulation of large amounts of dead wood caused by drought, hurricane winds, insect outbreaks etc. can lead to an increased risk of forest fires and thus the release of large amounts of C02 and habitat degradation. Dead wood mapping methods can be supported by photogrammetry techniques (especially in the case of open post-hurricane areas) and LiDAR as well. Modern ALS or ULS technologies are able to provide very dense point clouds, which, using advanced AI techniques, open up new possibilities for lying dead wood inventory. The test site Nature Reserve “Lipowka” in Niepolomice Primeval Forest (25,7 ha) established in 1954, is located in southern Poland is covered by natural old-growth oak-hornbeam forests (oak, hornbeam and lime: age 190 years, DBH 89 cm, H 33.0 m, growing-stock volume 581 m3/ha).  **Methods:**  Specially designed ALS LiDAR campaign (RIEGL VQ780i; 18 strips; overlap > 50%, cross-flights) carried out during the LEAF-OFF period were used for the research. The density of the ALS point cloud was approximately 120 pts/m2 (ground) and 560 pts/m2 (all classes). Detection of dead wood lying in the Lipowka reserve was carried out using the rules of the AI laslogic tool (rapidlasso GmBH). They made it possible to define objects (tree logs) and recognize them in a dense cloud of points. Those tree logs that deviate from the definition can also be recognized using fuzzy logic, with the rules being optimized by the AI system and, if necessary, modified with user participation. The set of rules can also be used to classify objects. The use of fuzzy logic allows the categorization of trees into fixed groups comparable to classes, without, for example, specifying exact height limits. Trees higher than the maximum set height are also taken into account and assigned to the set of standing trees. The evaluation of the created AI algorithms was made based on the number of correctly recognized tree logs and their fragments in relation to the reference data, which were classified tree trunks vectorized in the ALS point cloud and on a specially selected 1 ha area of the MHLS point cloud (ZEB Horizon). The algorithm also analyzes the directions of tree fall, which may provide an answer to the wind directions or the gravity of tree crowns to the gaps in the tree canopy that appear after the fall of the dominant trees.  **Conclusion:**  Automation of biometric measurements of dead trees, as well as their spatial mapping can provide contemporary foresters with important information regarding the history of forests and the dynamics of processes occurring in the past. |

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