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Landscape-level remote sensing for upscaling of land cover, above ground biomass and above ground carbon fluxes in the Lena River Delta (Northern Yakutia, Russia)

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Vegetation biomass is a globally important climate-relevant terrestrial carbon pool. Landsat, Sentinel-2 and Sentinel-1 satellite missions provide a landscape-level opportunity to upscale tundra vegetation communities and biomass in high latitude terrestrial environments. We assessed the applicability of landscape-level remote sensing for the low Arctic Lena Delta region in Northern Yakutia, Siberia, Russia. The Lena Delta is the largest delta in the Arctic and is located North of the treeline and the 10 °C July isotherm at 72° Northern Latitude in the Laptev Sea region. We evaluated circum-Arctic harmonized ESA GlobPermafrost land cover and vegetation height remote sensing products covering subarctic to Arctic land cover types for the central Lena Delta. The products are freely available and published in the PANGAEA data repository under https://doi.org/10.1594/PANGAEA.897916, and https://doi.org/10.1594/PANGAEA.897045.

Vegetation and biomass field data (30 m x 30 m plot size) and shrub samples for dendrology were collected during a Russian-German expedition in summer 2018 in the central Lena Delta. We also produced a regionally optimized land cover classification for the central Lena Delta based on the in-situ vegetation data and a summer 2018 Sentinel-2 acquisition that we optimized on the biomass and wetness regimes. We also produced biomass maps derived from Sentinel-2 at a pixel size of 20 m investigating several techniques. The final biomass product for the central Lena Delta shows realistic spatial patterns of biomass distribution, and also showing smaller scale patterns. However, patches of high shrubs in the tundra landscape could not spatially be resolved by all of the landscape-level land cover and biomass remote sensing products.

Biomass is providing the magnitude of the carbon flux, whereas stand age is irreplaceable to provide the cycle rate. We found that high disturbance regimes such as floodplains, valleys, and other areas of thermo-erosion are linked to high and rapid above ground carbon fluxes compared

to low disturbance on Yedoma upland tundra and Holocene terraces with decades slower and in magnitude smaller above ground carbon fluxes.