UAS Imaging Applications to Monitor Restored Peatlands

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Background

- Peatlands are globally threatened by land use and drainage.
- Most of the Finnish peatlands have been drained for forestry, agriculture and peat extraction.
- Pristine vegetation and peat-forming processes have been lost.
- Lowering water table initiates oxidation of peat to CO_2.
- Restoration activities can help drained peatlands:
    - i) to increase biodiversity by recovering the mire habitats
    - ii) to return natural functions in the catchment hydrology
    - iii) to reactivate natural storage of carbon and nutrients
- Monitoring of restored peatlands is important for several reasons:
    - i) to determine the technical success of restoration
    - ii) to see if the recovery process is activated
    - iii) to further develop restoration methods
- Traditional monitoring methods are laborous and time comsuming. New UAS-based datasets provide potential prospects:
    - i) to ease the demanding monitoring field work
    - ii) to decrease the subjectivity of the data
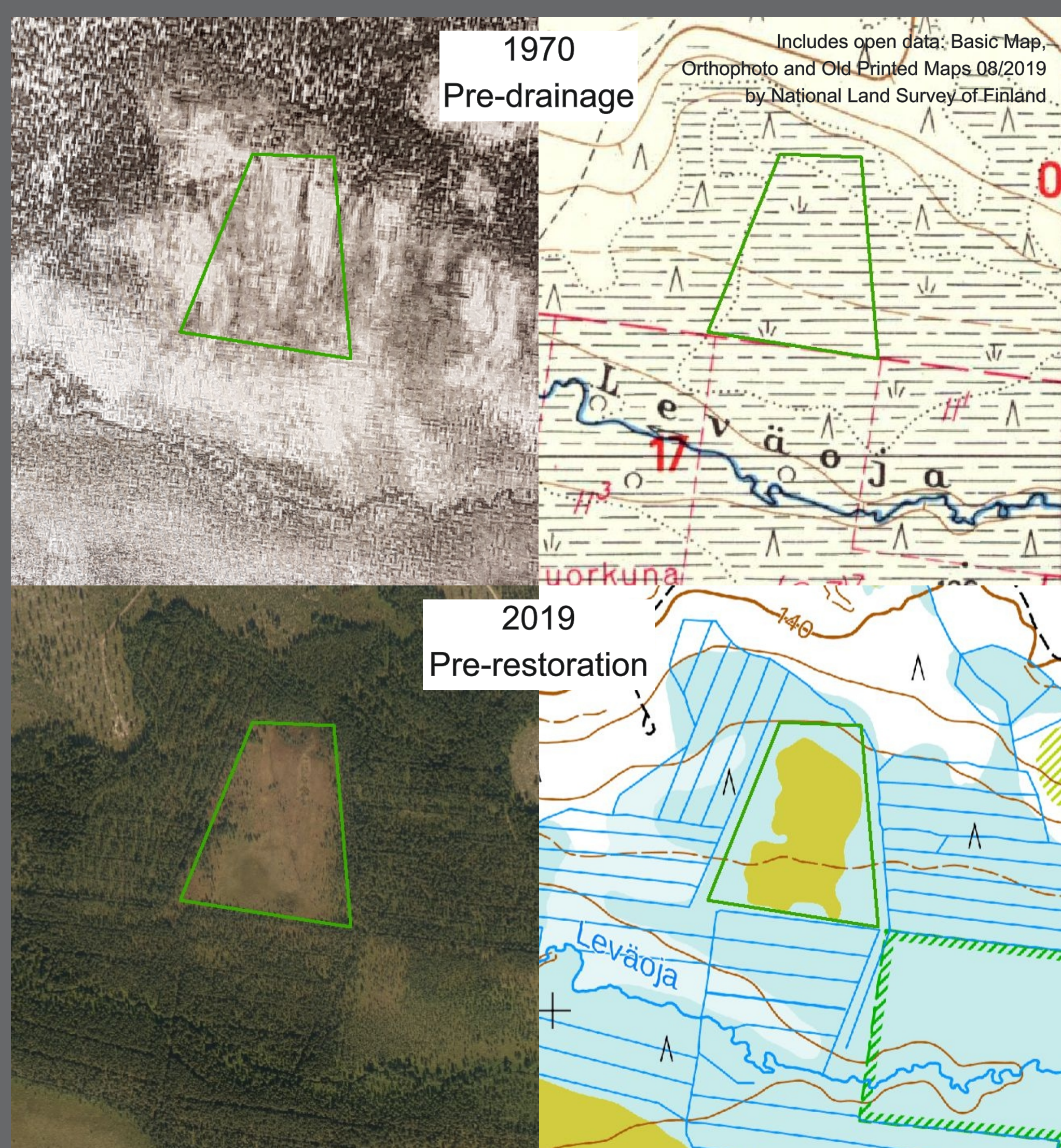   - ii) to increase the monitoring coverage at the sites

Figure 1. Aerial photograph and map comparisons between pre-drainage and pre-restoration conditions of strongly groundwater-fed Iso Leväniemi site in Olvassuo. Drainage was implemented in 1975 and forest growth has been intensive since then, for 44 years. The UAS study site (green border) has been left unditched, but the surrounding ditches have lowered the water table of the site.

Data and Methodology

- Hydrology LIFE project produces UAS imaging data for the study:
    - i) Visible (VIS)
    - ii) Near-infrared (NIR)
    - iii) Thermal infrared (TIR)
- Restoration success indicators to be derived from the data:
    - i) Manual and automated interpretation of the orthomosaics
    - ii) Classification of vegetation cover types
    - iii) Digital elevation models (DEM) for the site run-off model
    - iv) Vegetation and moisture indices
    - v) Water table elevation
- UAS-carried "wild cards" to be tested:
    - i) Lidar
    - ii) Hyperspectral
    - iii) Ground penetrating radar
- Reference data:
    - i) Manual visual field observations
    - ii) Soil moisture observations
    - iii) Vegetation and hydrological long-term monitoring
    - iv) Satellite imagery

Sites

- During the Hydrology LIFE project, 5 200 ha of peatlands are restored in 95 Finnish Natura 2000 protection areas.
- The sites have originally been drained for forestry purposes but protected later due to their natural value.
- Olvassuo and Mujejärvi sites were selected for the UAS study, since they include not only new restoration sites, but also former sites with historical vegetation and hydrological data available.
- The study focuses on open fens that have been drained 40-70 years ago and restored 0-20 years ago.
- For the new restoration sites, the flights will be performed before the restoration as well as one and two years after the restoration.
- In addition, data will be aqcuired from pristine reference sites to control the natural processes effect on the data.
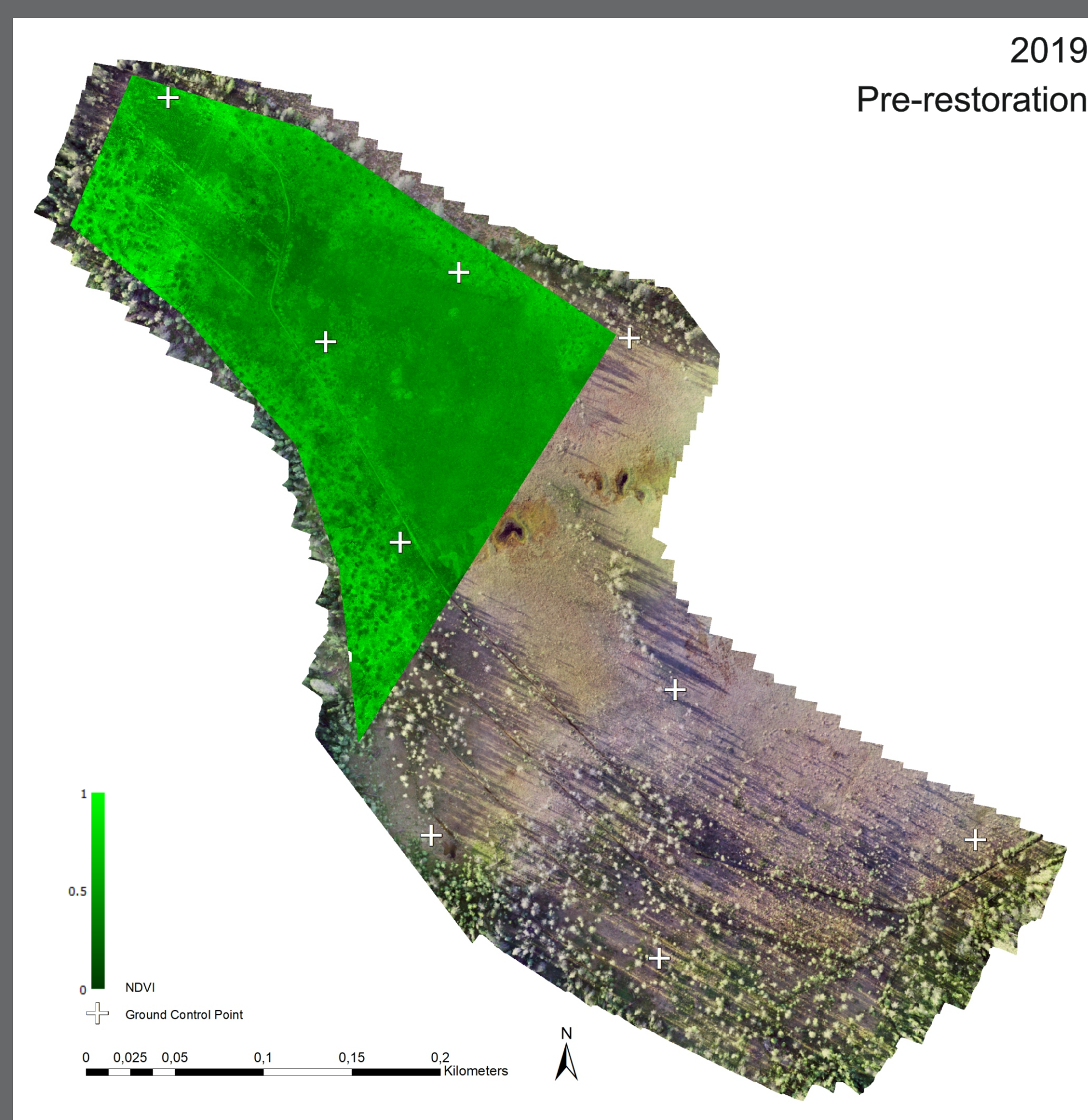

Figure 2. UAS-imaging-derived RGB orthomosaic picture and partial NDVI map (resolution 50 mm) for pre-restoration conditions of Loukkosuo site in Mujejärvi.
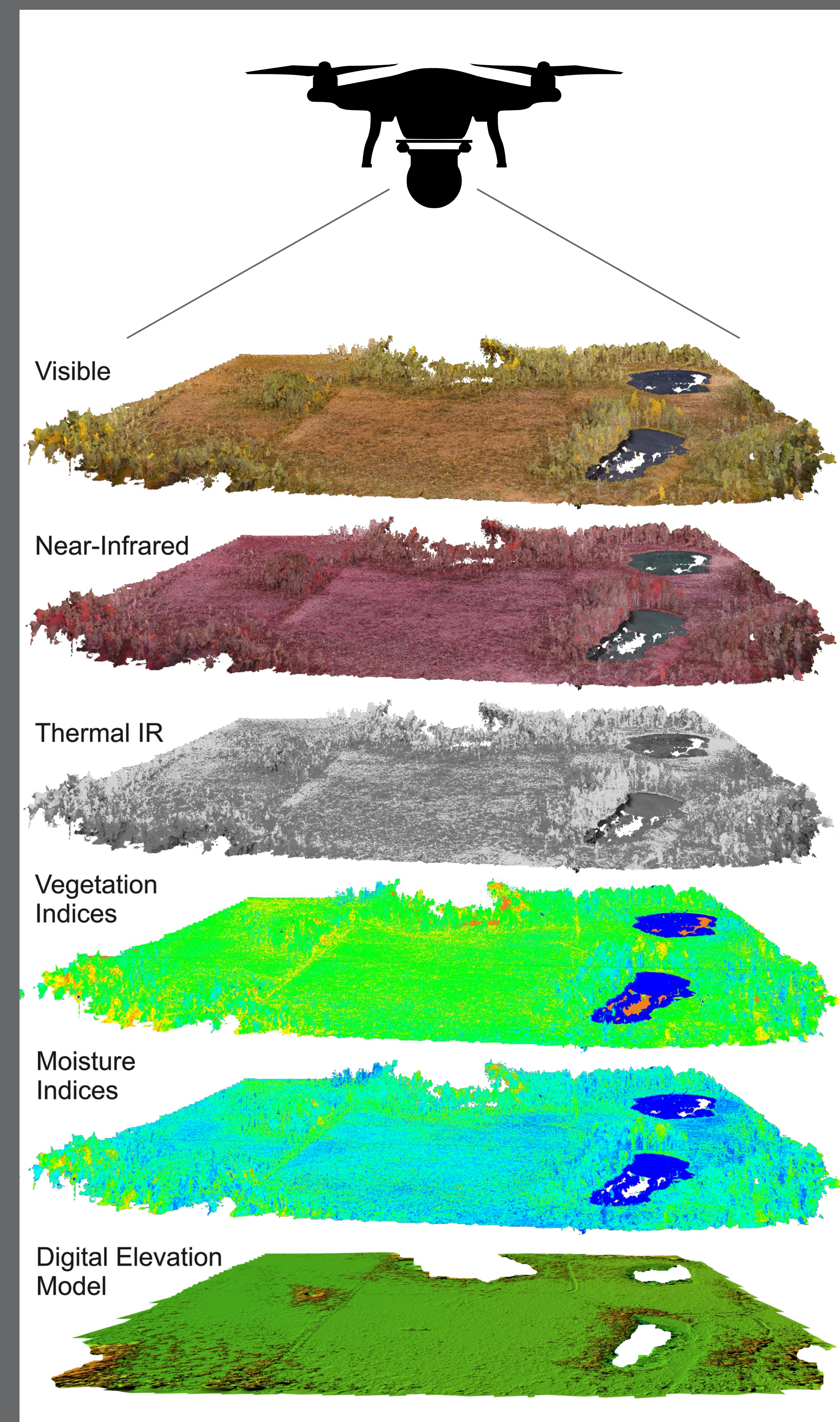

Figure 3. UAS-imaging-derived datasets and products with potential to correlate with peatland restoration success.

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