Technical note: A simple approach for efficient collection of field reference data for calibrating remote sensing mapping of northern wetlands

Magnus Gålfalk[1], Martin Karlson[1], Patrick Crill[2], Philippe Bousquet[3], David Bastviken[1]

[1]Department of Thematic Studies – Environmental Change, Linköping University, 581 83 Linköping, Sweden.
[2]Department of Geological Sciences, Stockholm University, 106 91 Stockholm, Sweden.
[3]Laboratoire des Sciences du Climat et de l'Environnement (LSCE), Gif sur Yvette, France.

Correspondence to: Magnus Gålfalk (magnus.galfalk@liu.se)

Supplementary Information S1 - Manual

Preparations – what is needed?

- A remote controlled camera with a wide field of view is required, e.g. a GoPro with a waterproof casing

- Remote control for the camera (e.g. an app on a mobile phone or tablet).

- A tripod and/or monopods giving an extendable total length of at least 3 meters (e.g. a tripod and a monopod put together).

- Note the camera model (if known also the horizontal and vertical field of view in degrees). These is important to be able to correct for image distortion (camera model dependent).

- A GPS for recording GPS position of the plots

- A log to write camera altitudes, plot descriptions etc.

- Make a calibration photo of the ground, with several distances marked on the ground in both directions (see Fig. 3 which is our calibration image after correction for lens distortion). Note the camera altitude used. Other altitudes can be used in the field although only one calibration photo is needed.

For each field plot:

1. One person holds the extended tripod supported by the ground (Fig. 1) or lifts it up for higher camera altitudes (e.g. when tall vegetation such as bushes are present).

2. Imaging should be done from an altitude of at least 3 meters

Alternative 1 (which we have used) is to stand at the edge of a plot and tilt the camera so that the horizon appears close to the top of the image (Fig. 2A). This horizon coordinate can then be used in post-processing to find angles in the image. With a vertical field of view of at least 90 degrees, nadir angles will also be present in the same image.

Alternative 2 is to stand in the center of the plot and tilt the camera straight down (nadir direction). This will make all the angles in the image closer to nadir which makes the classifications easier (as tall vegetation will not obstruct the view towards lower vegetation as much). The person and tripod will be included in the image using this method but will only take up a small part of the image which can be avoided in post processing classification.

3. Another person notes the camera height, GPS position, the direction of the field of view relative to the GPS position, and uses a remote control (such as an app on a water proof mobile phone) to take an image of the plot. The time should be noted in the log for each plot so that images can be matched to the correct GPS positions.

10 4. Take 3-4 close-up images (Fig. 5) of main classes of land cover (e.g. the most dominating plant types in the area). By tilting the tripod/monopod, the same wide-angle camera is used for quick close-up imaging of different parts of the plot right after taking the higher altitude image.

5. Post processing can be done in two ways:

15   a)   Using generally available or commercial software for distortion correction (e.g. Adobe Photoshop, Lightroom, or scripts in programming languages) and land cover classification (e.g. CAN-EYE, VegMeasure, SamplePoint, or eCognition).

     b)   Send images and related information to the lead author who can assist. For this option, we ask image senders to agree on making images and post processed results publicly available via a database hosted by the authors. The aim of this

20   is to over time build a public database that can be used as a ground truth archive for remote sensing products. Request the post processing software from the lead author (magnus.galfalk@liu.se). However, please be aware that the software is not user friendly at its present stage as it is not commercial and that there is limited time for support.

Supplementary Information S2 – An additional field plot example
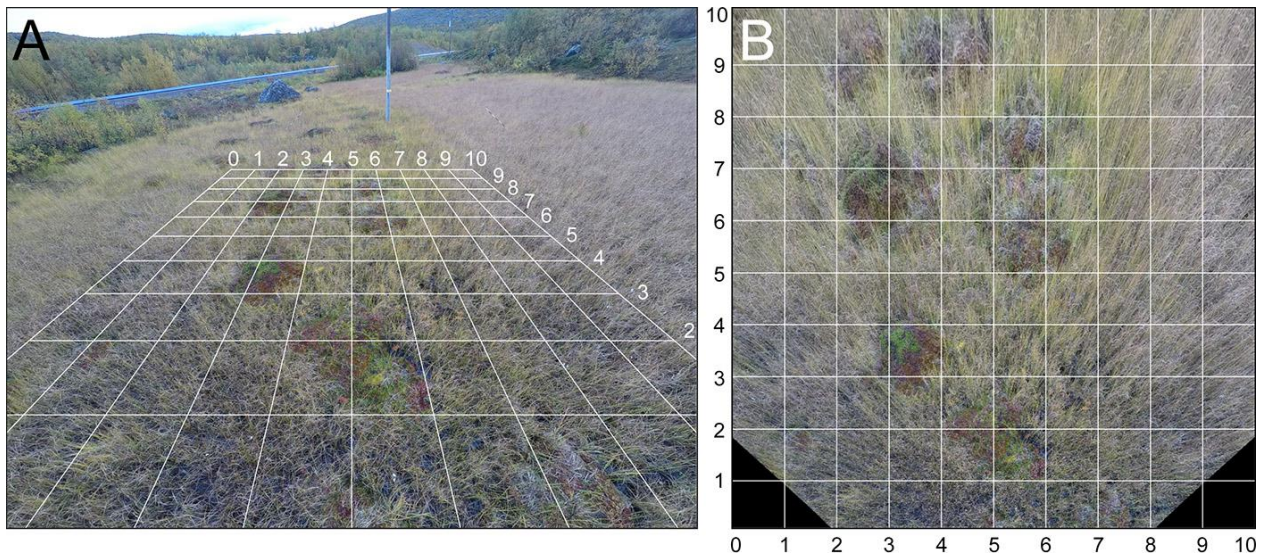
Figure S1: One of our field plots. (A) Image corrected for lens distortion, with a projected 10 x 10 m grid overlaid. (B) Image after recalculation to overhead projection (10 x 10 m).
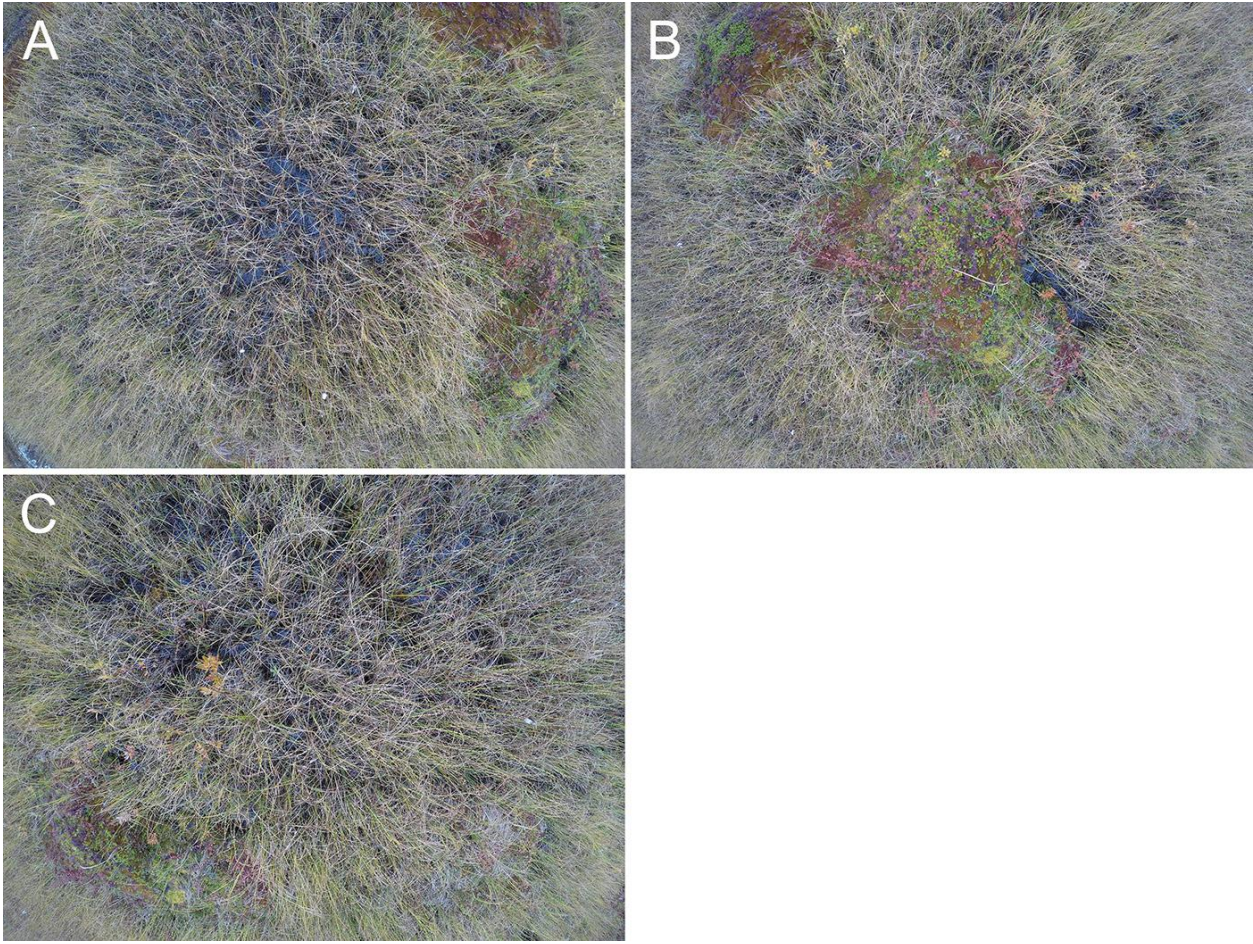
Figure S2: Close-up images in one of our 10 x 10 m field plots (Fig. S1).
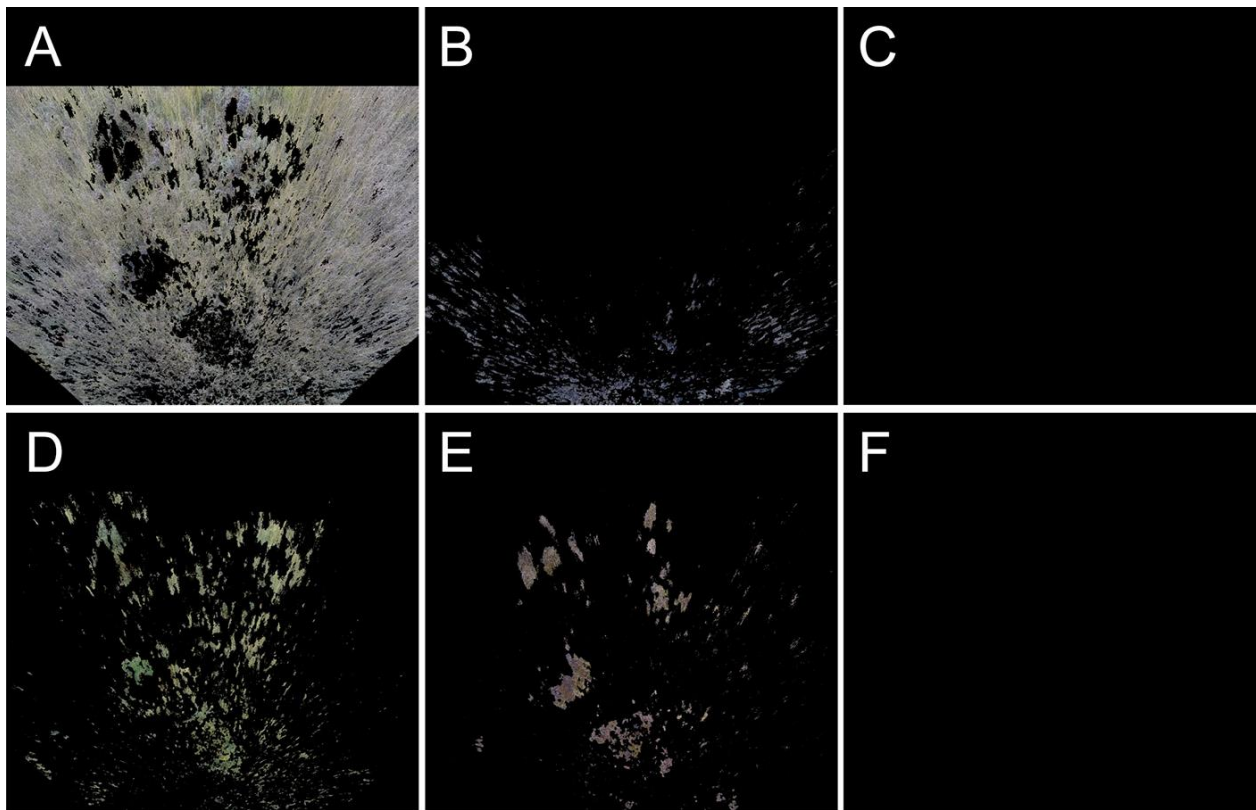
Figure S3: Example of a field plot image with classification into the six main surface components. All panels have an area of 10 x 10 m. (A) Graminoids. (B) Water. (C) Shrubs. (D) Dry moss. (E) Wet moss. (F) Rock.